DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

JANUARY, 1943

February MACHINERY will tell about the production miracles being achieved at the Willow Run Bomber Plant, which was conceived and built by the Ford Motor Co. This plant staggers the imagination—it does not seem possible that so huge an enterprise could be completed in only eighteen months. The plant is now in operation; the volume is being increased daily, and in a very short time the output will be phenomenal. The forthcoming article was obtained by MACHINERY'S staff with the cooperation of the Ford organization and with the approval of the War Department. It will be the first article to appear in a technical publication on these mass production facilities that will play so important a part in crushing the Axis powers.

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Producing the Reising Gun

"The Reising Gun will Lick the Rising Sun"—an Employe Slogan at the Harrington & Richardson Plant—Indicates the Determination with which the Production of This New Weapon is being Pushed to Higher and Higher Levels. Some of the Steps in the Manufacture of This Compact, Yet Powerful Sub-Machine Gun are Described in This Article

By HOLBROOK L. HORTON

THE Reising gun, made by the Harrington & Richardson Arms Co., is a new weapon, which reached the factory development stage in 1940 and was accepted by the Marine Corps early in 1942. It is now being manufactured in three models, two of which are designated as sub-machine guns, and the third as an automatic rifle. All are of 0.45 caliber.

Of particular interest is the Model 55 sub-machine gun. This has a short pistol-grip type of stock, to which is fastened a folding shoulder brace of heavy steel wire, as shown in Fig. 1. It makes an especially compact and quickly readied weapon of potent fire power for troops landing by water or air. This model is also well suited for use by tank crews. It is compact enough to be readily placed on racks, and it can be used through a firing port as easily as a pistol. In addition to these advantages, it is surprisingly light, weighing only 7.65 pounds with fully loaded magazine, so that it can be easily carried during parachute descent.

The Model 50 sub-machine gun, shown diagrammatically in Fig. 2, is distinguished by its conventional rifle stock and by its compensator. The latter is a device fitted to the muzzle of the gun to assist the combatant in controlling the direction of automatic fire. This is accomplished by directing the gases escaping from the muzzle in a direction counter to the motion of the gun.

This rugged arm was invented by Eugene G. Reising, and, as previously stated, its development and manufacture began at the Harring-

Fig. 1. Close-up View of the Model 55 Sub-machine Gun, Especially Adapted to Paratroop and Tank Use. With Wire Shoulder Brace Folded Forward, the Pistol-grip Stock Permits the Gun to be Fired from Almost Any Position

ton & Richardson plant in Worcester, Mass., in 1940. By October 10, 1940, a pilot model had been produced which, when tested, fired 3470 rounds with only two malfunctions, one of which was due to defective ammunition. Further tests at the Aberdeen, New River, and Quantico Proving Grounds resulted in the adoption of the gun by the Marine Corps.

The design of this gun makes it well adapted to large-scale interchangeable manufacture. Tolerances are relatively wide, the number of working parts is small, and the action of the gun is essentially quite simple.

The Reising gun is an air-cooled, delayed blow-back, semi- or fully-automatic magazine-feed, hand or shoulder weapon, which is intended to be fired from any position, with one or both hands. The fully automatic model has a relatively short barrel, but is capable of accurate and intensive fire within a range of 300 yards. The semi-automatic model, with a longer barrel, has a maximum effective range of 400 yards. The thumb-slide shown in Fig. 3 is used on all three models. In the fully automatic model, it may be set, as illustrated, at Safe, SA (semi-automatic), or FA (fully automatic). A box type of magazine is used, and this holds twenty rounds of 0.45-caliber ball type or tracer type cartridges or their commercial equivalents. The cyclic rate of fire is 450 to 600 rounds per minute, but the deliverable rate of fire is naturally much lower, being limited by the dexterity of the operator in inserting magazines and his ability to aim and fire rapidly.

Harrington & Richardson were in a favorable position to go into full-scale production of this gun shortly after the attack at Pearl Harbor, since they had discontinued production of their peacetime firearms line some time previously, and were well along in their plans for manufacture of this new arm.

After the period of initial production, which extended up to April, 1942, the rate of manufacture rose sharply. The new general manager, F. A. Smith, formerly with the Greenfield Tap & Die Corporation, who took over the direction of the company's operations at that time, introduced more extensive and thorough gaging practice, closer control over the setting up of machines and the sharpening of tools, a continuing check on the quality of materials used, and in addition, instilled a new spirit of confidence and determination in the Harrington & Richardson workmen.

The score board shown in Fig. 4 has proved to be of great importance in stimulating interest by keeping the workmen informed concerning any changes in the production schedule, including sudden increases due to emergency orders, and the success with which the demand for guns is being met on time.

In the early stages of manufacture, the assembly of each gun had been pretty much a question of hand fitting and selective assembly. With the introduction of improved gaging and machining practice, the stage of quantity production was reached, and difficulties in the assembly dropped to a minimum. These factors, plus the whole-

hearted cooperation of its employes, enabled the Harrington & Richardson Co. to fill all of its contracts with the Marine Corps on time, or ahead of time. In August, 1942, weekly production was 500 per cent of what it had been in April, 1942. This sharp upward climb in production over the intervening four-month period was obtained without increase in the number of workmen employed.

This article will describe some of the machining operations on the more important components of the gun—the barrel, the receiver, and the action bar. The receiver, which contains the bolt and hammer, is fastened to the barrel and provides pivoting support for other parts of the firing mechanisms directly below it. The function of the bolt when at rest is to hold the cartridge firmly in the chamber, and at the same time provide support for the firing pin. When the gun is fired, the bolt is thrust backward by the expanding gases in the breech after a momentary delay which allows the bullet to clear the muzzle. In moving backward, the bolt recocks the hammer.

The action bar extends part way along the gun below the barrel, and has three chief functions. In the initial operation of the gun, it is pulled back manually to cock the hammer for firing the first shot. In semi-automatic operation, the recoil movement of the action bar after the gun is fired releases the disconnector from engagement with the sear through a cam, so that the hammer can be re-engaged in preparation for firing the next shot by trigger action. In fully automatic operation, the discharge of the arm forces the action bar back, and as its return movement is about to be completed, it causes the connector to rotate the sear so that

Fig. 2. Details of the Model 50 Gun, which has a Standard Shoulder Stock and a Compensator on the Muzzle End to Aid in Maintaining Accuracy in Automatic Firing. The Hammer is Shown in Cocked Position, Ready for Firing

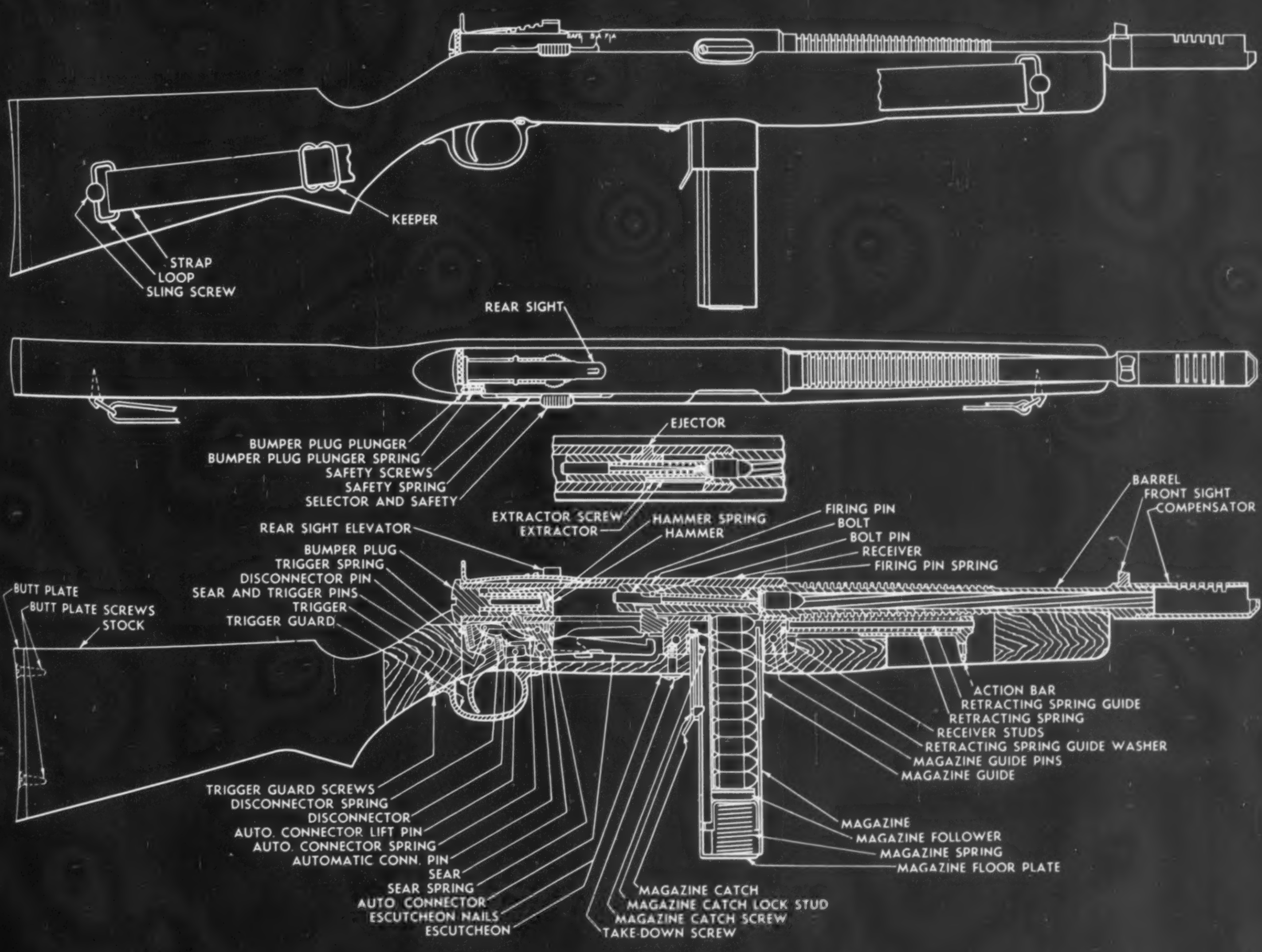


Fig. 3. A Thumb-slide Controls the Selection of Firing Action Desired. When Fully Retracted, it Maintains the Gun in the "Safe" or Inoperable Condition. Moved to SA, the Gun can be Fired Semi-automatically, with a Shot for Each Pull of the Trigger. Moved to FA, the Gun can be Fired Fully Automatically, that is, up to Twenty Rounds with the Trigger Held Back

the hammer is released for firing the next shot automatically.

The first operation on the barrel is to cut it to length from rough stock on a Foster chucking lathe. It is then drilled to a diameter of 0.430 inch on a Pratt & Whitney barrel-drilling machine, and both ends are countersunk. The outside of the barrel is turned in two roughing cuts and one finishing cut. The barrel is straight for a distance of about 3 1/4 inches back from the muzzle end, and then tapers outward. At the smallest diameter it is 0.655 to 0.646 inch. The extreme muzzle end is turned to 0.955 to 0.952 inch.

The breech end of the barrel is then turned to a diameter of 0.873 to 0.8716 inch in preparation for threading, and a groove is cut at each end of this section. Cooling fins are next turned on the section of large diameter near the breech end with a form cutter. A 7/8-18 thread is then cut on the breech end to fit into the receiver, and in the case of the Model 50 barrel, a 7/8-24 thread is also turned on the muzzle end to fit into the compensator.

The next operation, shown in Fig. 5, is the profile-milling of two slots, one across the breech end to form the ejector clearance, and the other on the top near the muzzle end for the front sight. The latter slot is being profile-milled at present in two operations, the second producing the dovetailed form. It is expected, however, that this slot will soon be cut in a single broaching operation. Before insertion in the holding fixture, the breech end of the barrel is screwed tightly into a square block which, when inserted in the rear part of the fixture, insures the proper location of the barrel to receive the qualifying mark on the breech end. This mark is cut into the barrel as it is pressed down on a knife-edge by the holding fixture clamps. The qualifying line is needed to insure the correct alignment of barrel and receiver upon assembly.

Following this is one of the most interesting operations in the making of the gun—the broaching of the rifling grooves. This is accomplished on a Lapointe variable-speed hydraulic broaching machine, as shown in Fig. 6. After being reamed, the barrel is placed in the broaching machine, and the broach is pulled through the bore, the barrel being rotated by the self-leading action of the broach, so that six helical grooves about 0.00375 inch deep are formed. The cut of

Fig. 4. This Production Score Board Keeps the H & R Employes "on Their Toes." So far. They have Met or Bettered the Due Date for Every Marine Corps Order

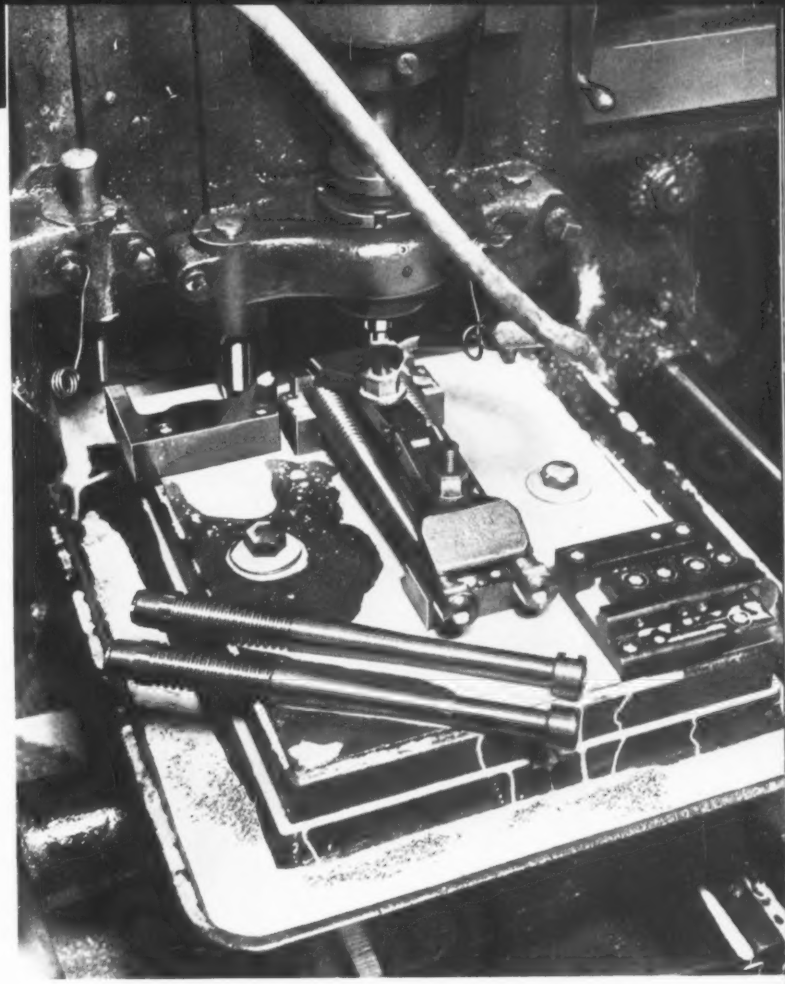


Fig. 5. Two Operations on the Barrel. The Straight Slot across the Breech End and the Dovetailed Slot across the Top of the Muzzle End are Profile-milled. A Qualifying Line is Cut by a Knife-edge into the Breech End when the Barrel is Clamped in the Fixture. Two Examples of Work are Shown, an Unfinished Barrel being Seen at the Front, and a Finished Barrel at the Rear

each successive broach tooth is both wider and deeper than that taken by the preceding one.

To insure constant lubrication of the broach during the rifling operation and to prevent injury to the bore of the barrel by loose chips, the positive feed lubricating device shown in Fig. 7 is used. As shown, the breech end of the barrel is held against the lubricating fixture in a thrust type ball bearing. Another ball-bearing arrangement supports the muzzle end (not shown). The barrel is thus free to rotate as the broach is pulled through it.

Lubricating fluid is introduced through a hose from a gusher pump into the fixture near the thrust type ball bearing. A spring maintains even pressure of the bearing against the barrel end, and at the same time, permits rapid removal and insertion of the work. At the opposite end of the fixture is fitted a copper tube with closed end, which prevents the lubricating fluid from escaping. As the broach passes through the bore it carries the lubricating fluid with it.

The chamber is counterbored and reamed in the breech end, and the barrel is then squared to length with an end-mill. A bullet ramp is also milled at an angle, extending from the lower edge of the breech end up to the chamber. Fig. 9 shows a cartridge being pushed up the bullet ramp into the chamber by the bolt. Final operations on the barrel include scraping of the bullet ramp and polishing of the chamber. The barrel is then ready for proof-firing.

The receiver is machined from round stock 1 1/4 inches in diameter. It is first drilled, and then broached to 0.754-0.755 inch on a similar type of machine to that used for rifling the barrel. Both ends of the receiver are faced with a milling cutter mounted in a drilling machine. A 60-degree chamfer is formed on the edge of the hole at each end to provide a true locating surface.

Two grooves forming the track are milled along the outside of the receiver at a distance of 0.748 inch from the inside edge of one to the inside edge of the other, using a form cutter to produce straight sides and a curved bottom. A slot 0.624 inch wide is milled for the rear-sight elevator clearance. Continuation of this slot into a dovetailed slot for the rear sight is accomplished by profile-milling.

A series of drilling, tapping, and reaming operations is rapidly accomplished on a six-spindle Delta drilling machine, using the jig shown in Fig. 8. At the first spindle, four holes 0.506 inch in diameter are spot-drilled. At the second spindle, five holes 29/64 inch in diameter are drilled. At the third spindle, four holes are tapped, using a 1/2-inch-24-thread tap. At the fourth spindle, a hole for the rear sight is spot-drilled, and a 15/64-inch hole is drilled. At the fifth spindle, the ejector hole is reamed to 1/4 inch. At the sixth and final spindle, two holes are drilled at an angle, using a No. 33 drill. This operation and examples of the work are shown at the right. The jig shown in this illustration is designed to hold the receiver so that the successive operations can be rapidly performed, and a production of between 15 to 18 pieces per hour is obtained.

The ejector and magazine port holes are then countersunk and the four stud holes are counterbored. The ejector port, the magazine opening, and the action-bar slot are cut out in three spline-milling operations. Both ends of the mag-

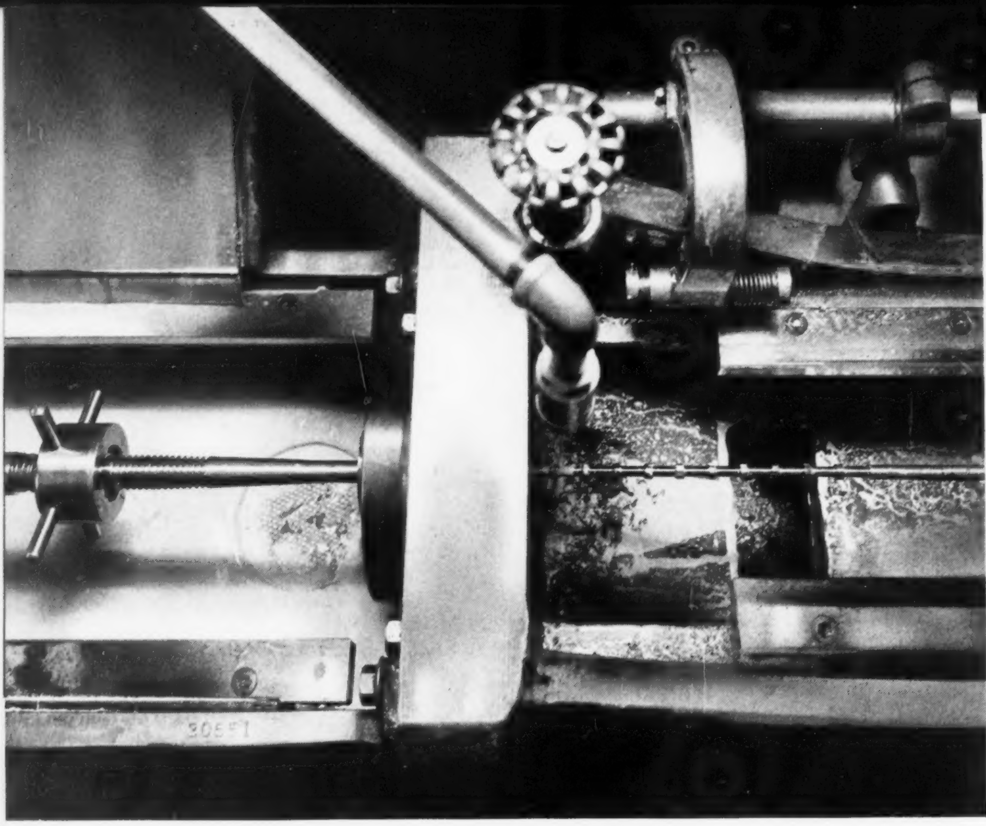


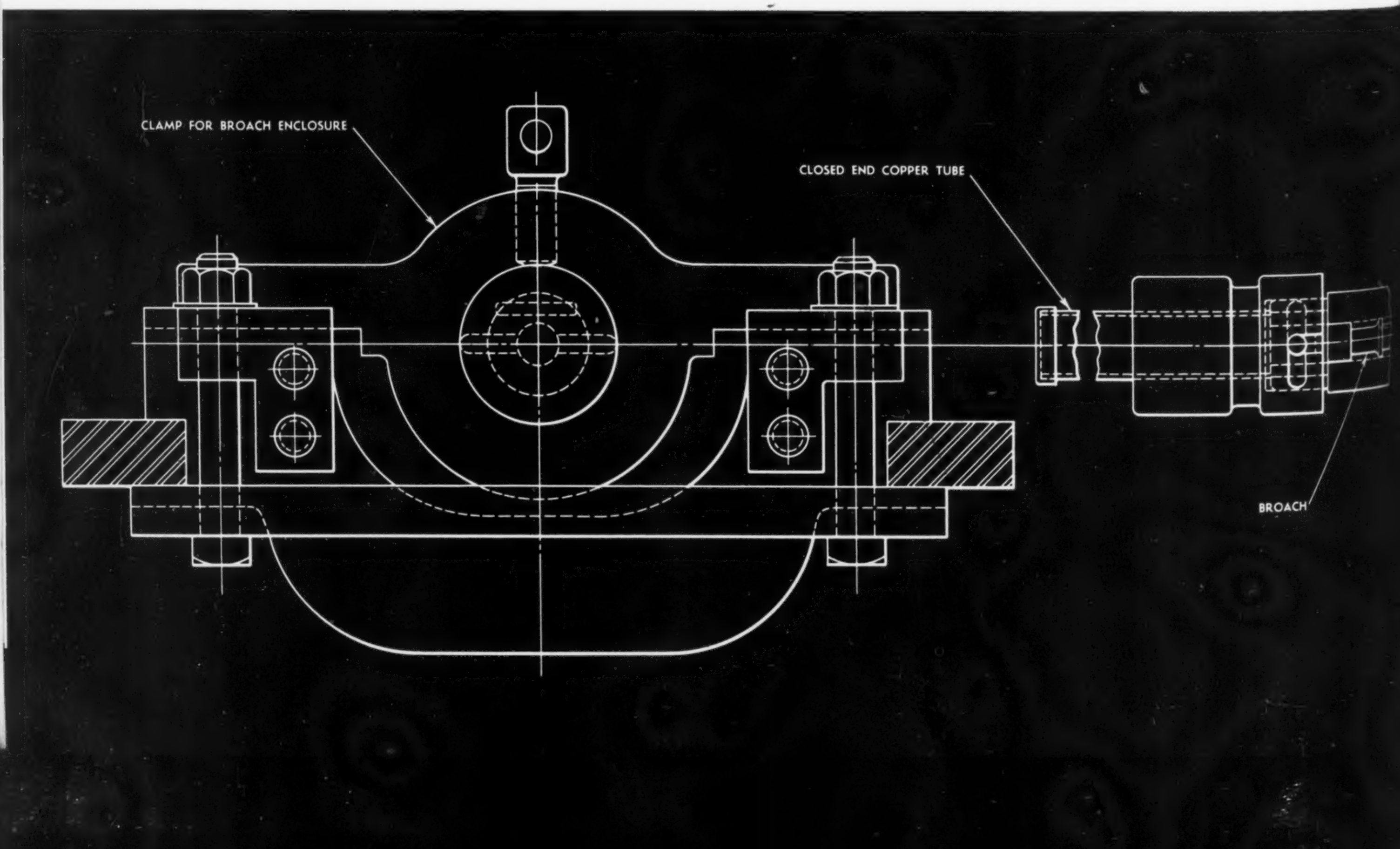
Fig. 6. Rifling by Broaching with a Single Pass of the Broach. The Breech End of the Barrel is Held against a Thrust Type of Ball Bearing, and the Barrel is Free to Rotate under the Self-leading Action of the Broach. Positive Lubrication is Supplied through the Bore by Means of the Special Fixture Shown in Fig. 7

azine opening are then shaved simultaneously to a square contour, and one end of the action-bar opening is similarly cut.

Rose reamers are used to cut the cartridge entrance and also to form the rounded, slanting edges on the ends of the ejector port. The four stud holes are retapped by hand, and the safety holes are reamed and tapped.

The next operation is to set four studs in the threaded holes lined up along the receiver body. Each stud is first turned in by hand over a ring of silver solder, which fits between the shoulder of the stud and the receiver. The receiver is then taken to a drilling machine equipped with an over-running chuck having an automatic gripping arrangement. Around the inside of the chuck are steel rollers fitted between rubber spacers, so that when the chuck is squeezed down over the stud the rollers grip it firmly, and the machine then turns it up tightly against the silver solder ring. The over-running feature prevents the chuck from being damaged.

Fig. 7. Arrangement for Supplying Positive Lubrication during the Broaching of the Rifling Grooves. Lubricating Fluid is Supplied to the Enclosure Surrounding the Broach, and is Carried into the Barrel Bore as the Broach is Pulled through, thus Providing Lubrication and Preventing Damage by Loose Chips



A new Detrex degreasing machine has been installed, and is to be used to clean the receivers just prior to the soldering of the studs. A tray of receivers at an earlier stage of machining is shown in Fig. 10 being rinsed in the clear water solution after having been held in the boiling trichlorethylene solvent.

An interesting feature of this tank is that the four sides are water-cooled, so that the heavy vapors arising from the solvent are condensed and run back into the container. The top of the tank can thus remain open without requiring any ventilating hood, and parts to be cleaned can be readily lowered or lifted from the tank. After being rinsed, the parts are suspended in the vapor just above the boiling solvent for a few moments, and when removed, are dry and clean. The entire operation takes about two minutes.

The receiver then goes to a Thermionic welding machine, built by the Induction Heating Corporation, where the studs are silver-soldered to the receiver, as shown in Fig. 11. This operation takes about fifty seconds. Preparatory to soldering, a compound is spread over the receiver surfaces adjacent to the studs, in order to prevent the adherence of excess solder, which may run out of the joints.

Following this, the receiver is subjected to two broaching operations. The first, using a broach which is flat on one side for two-thirds of its length and completely round for the remainder, removes the ends of these studs protruding into the bore, and produces a round contour. The second broaching, as shown in Fig. 12,

Fig. 8. Last Operation Performed by a Six-spindle Gang Drilling Machine on the Receiver. With the Aid of the Jig Shown Eighteen Operations on Nine Holes are Accomplished in Quick Succession. Unfinished and Finished Pieces are Shown at the Right

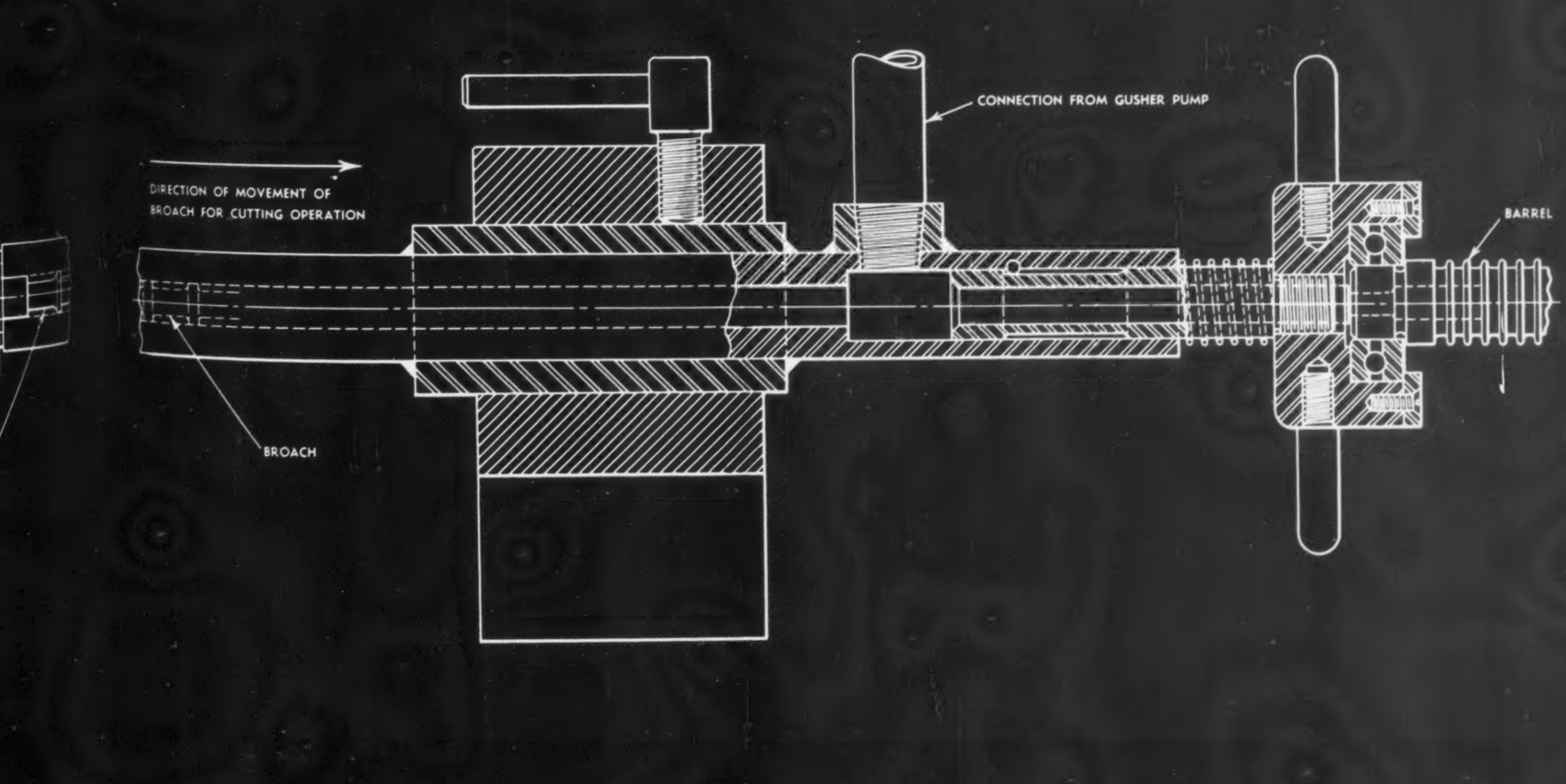


Fig. 10. Group of Receiver Blanks being Rinsed after Cleaning in the Boiling Degreasing Solution in the Right-hand Compartment. The Sides of the Tank are Water-cooled to Prevent Escape of the Cleaning Vapor. The Condensate Shows as a Dark Band around the Lower Portion of the Tank Sides

brings the bore to the final diameter of 0.754 to 0.755 inch.

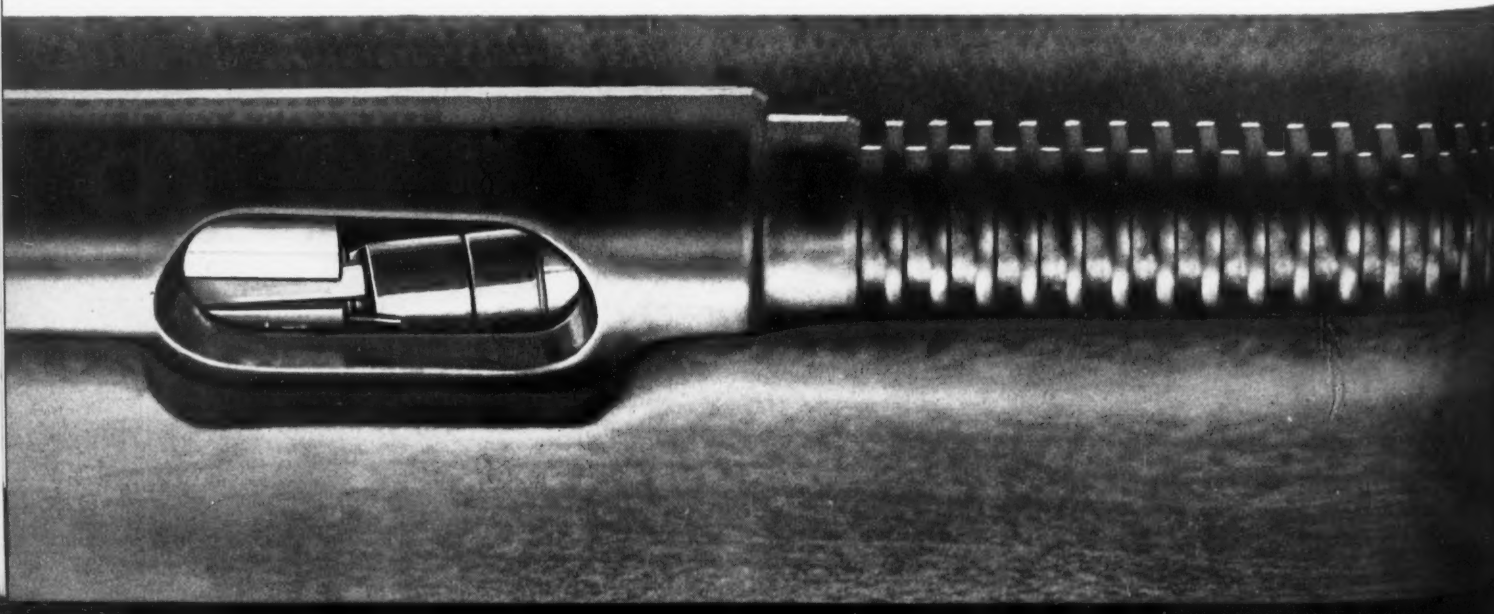
The two studs on the front end are now straddle-milled to form flat sides 0.499 to 0.501 inch wide. The inside surface of these studs are then straddle-milled to fit the magazine guide box. Slots are also milled in the two studs at the rear end. Various holes are drilled and reamed in the studs, and clearance for the connector is milled on the rear stud. The barrel end of the receiver is counterbored, and the rear end is tapped for the bumper plug.

Fig. 9. Close-up View through the Ejector Opening of the H & R Reising Gun, Showing the Cartridge being Pushed up the Bullet Ramp into the Chamber by the Bolt

In Fig. 13 is shown a receiver being tapped at the front end to receive the barrel. A variation of 1/8 inch is allowed in the starting point of this thread. A threaded brass collar at the top of the fixture acts as a lead-screw. When a new tap is used, a trial piece is tapped, and the collar is then adjusted to locate the start of the thread within the allowable 1/8 inch. When the receiver is placed in this fixture, it is pressed against a knife-edge, which cuts a qualifying line at the barrel end. After barrel and receiver are screwed together, the qualifying lines on each must be in alignment to insure the proper relative locations of sights and bullet ramp.

One of the most important operations on the receiver is the reaming of the bolt-locking cut well down inside and at a 23-degree angle with the bore, as shown in Fig. 14. This cut forms a recess into which the bolt shoulder fits when it is in locking position, and a lip which momentarily prevents the bolt from moving backward when the cartridge is fired, thus effecting a delay in the blow-back operation. By making this cut at a slight angle to the bore, and the lip at a slight angle to the perpendicular, the increasing pressure in the breech finally forces the bolt out of the locked position, so that it slides downward and backward.

Following various filing, scraping, and polishing operations, a narrow band about 2 to 3 inches wide, extending along each side of the



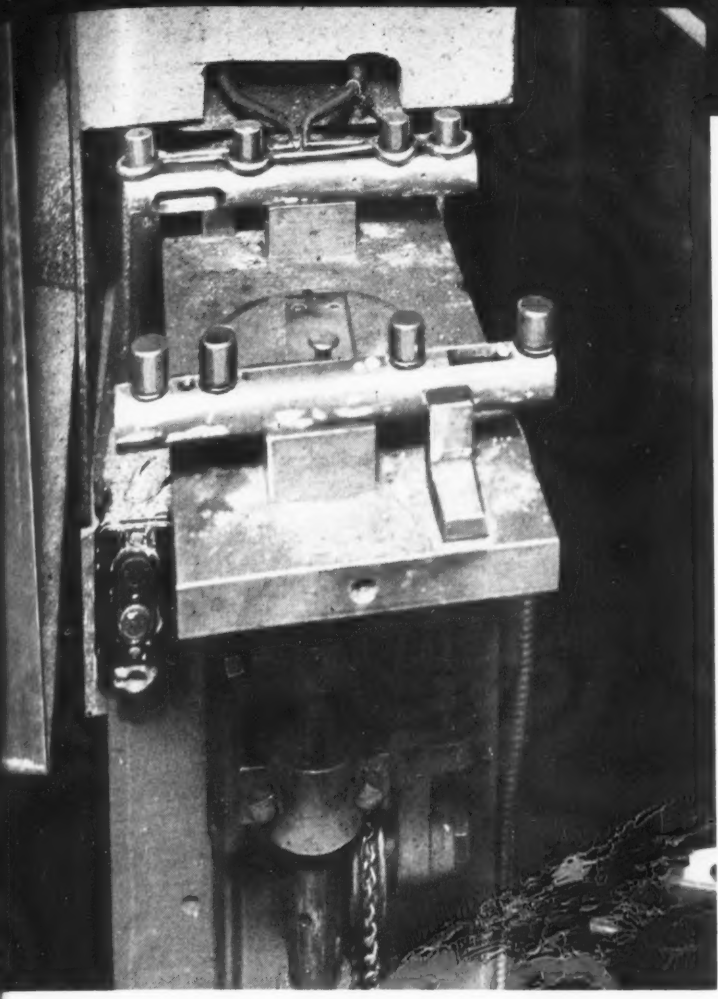


Fig. 11. Studs that Support Part of the Firing Mechanism of the Gun are Threaded into the Receiver over Rings of Silver Solder. This Induction Heating Operation Fixes Them Firmly in Place. The Piece at the Front has just been Treated with a Compound to Prevent Adherence of Excess Solder

locking slot lip, is spot-hardened to Rockwell C 40-50. This hardening operation is being accomplished at present with an oxy-acetylene torch, but will be done later by induction heating. It is necessary to harden the receiver at this point, since the frequent camming action of the bolt over the lip would otherwise result in considerable wear.

The action bar in nearly completed form is shown in [illegible]. The small hole that lies at the far end of the recess in the bar is a spring

Fig. 12. Broaching the Receiver after Studs have been Soldered into Position. Most of the Teeth of the First Broach Have a Flat Edge to Remove the Ends of the Studs Projecting into the Bore. A Few Round Teeth at the End Form the Circular Shape. A Second Broach Brings the Bore to its Proper Diameter

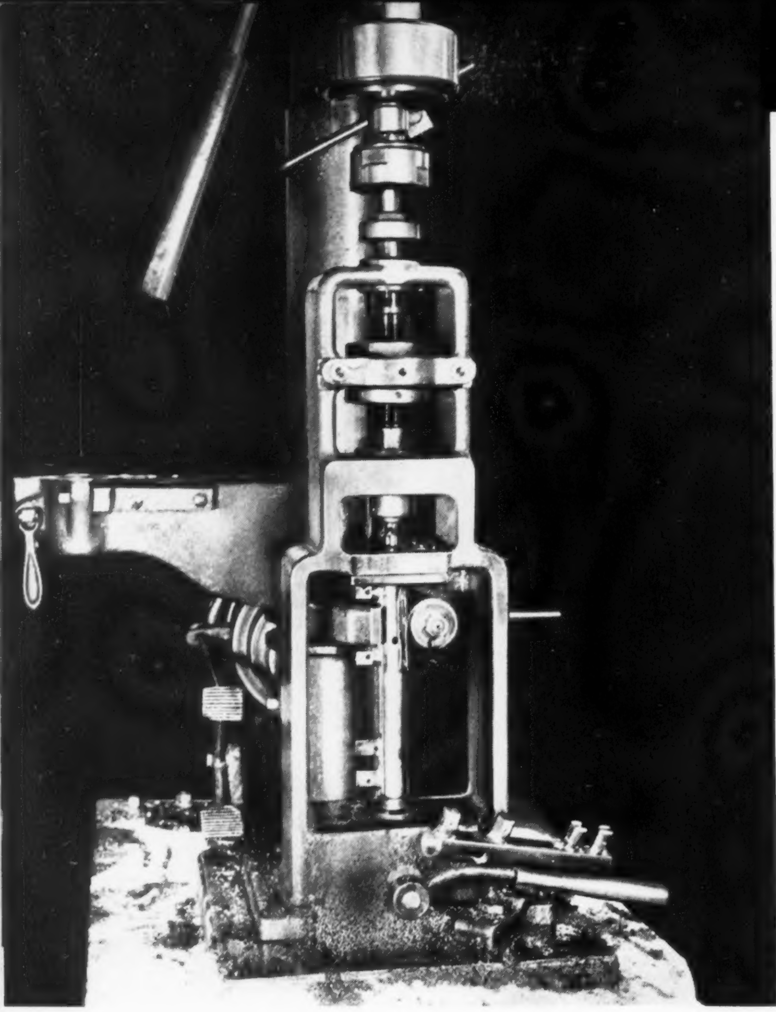


Fig. 13. Tapping the Breech End of the Receiver. In the Upper Part of This Fixture is a Brass Collar which Acts as a Lead-screw, and Enables Each New Tap to be Adjusted so as to Start the Thread within a 1/8 Inch Arc. This is Necessary to Secure Accurate Alignment of Receiver and Barrel

guide hole. In order to counterbore this hole, the ingenious arrangement shown was set up. The two universal joints and connecting-rod permit the tool to be offset and held in a supporting guide block. During the operation, the part is held tightly against the fixture by hand.

Several small parts are used in the construction of this gun. One of the most essential of these is, of course, the trigger. In Fig. 16 is shown a number of trigger blanks being ground on a Blanchard surface grinder. The blanks are surface-ground on one side only, the other side having been previously disk-ground to remove scale and burrs. The machine illustrated grinds

Fig. 14. An Important Operation on the Receiver is the Cutting of the Locking Shoulder, which Momentarily Prevents the Bolt from Moving Backward when the Gun is Discharged. The Cut is Reamed at a 23-degree Angle with the Bore of the Receiver

Fig. 15. Ingenious Arrangement for Counterboring an Inaccessible Hole in the Action Bar. This Counterbore can be Seen at the End of the Small Slot in the Bar. During the Actual Operation, the Work is Held by Hand against the Fixture

Fig. 16. Surface-grinding Trigger Blanks. 132 Blanks are Held on the Magnetic Chuck for Grinding at One Time

132 blanks at one time to a thickness of 0.233 to 0.235 inch.

In the past, all parts were finished by browning, but a change has now been made to Parkerizing. This is a more rapid finishing operation, and provides a higher degree of resistance to corrosion, a very necessary factor when the guns are taken to tropical humid climates.

One of the factors that has helped considerably in decreasing the number of rejections all along the line has been the positive, helpful attitude of both company and Marine Corps inspectors. They have taken the view that their job is not simply to find and sort out defective parts, but to eliminate the causes of the defects.

A roving company inspector, assigned to each department, inspects each operation about every fifteen to twenty minutes. Four or five samples are selected by the inspector for gaging. Certain operations, such as the drilling and reaming of the barrel, are 100 per cent gaged and visually inspected. The bolt, fire control, rear sight, and magazine catch are 100 per cent visually inspected and gaged for all dimensions. A number of small parts are partially machined in other plants, and these are 100 per cent inspected in the receiving department.

Fig. 17 shows the finished barrel being proof-fired with a special test cartridge developing 150 per cent of the explosive pressure of the regular cartridge. In addition to this proof-firing of the barrel, each assembled gun is test-fired with forty rounds of regular ammunition. Each gun destined for Marine Corps use is then taken down, cleaned, and the parts are laid out for the Marine inspectors. Should any unsatisfactory part be found at this stage, a new one is substituted, the gun is reassembled, again test-fired, and then taken down and re-examined as before.

When passed as satisfactory, the parts are reassembled and the completed guns ordered by the Marine Corps are actuated without firing by the Marine inspectors to test their action. The last test of these guns is an official inspection of the barrel, in which a steel mirror is used to reflect light through the barrel so as to show up any scratches or other surface defects.

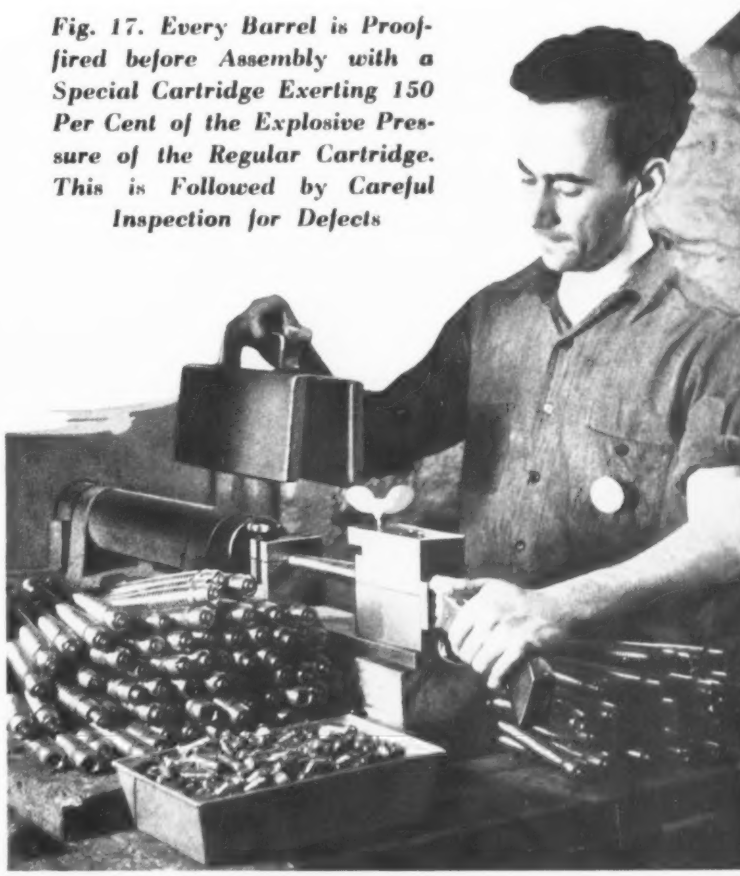


Fig. 17. Every Barrel is Proof-fired before Assembly with a Special Cartridge Exerting 150 Per Cent of the Explosive Pressure of the Regular Cartridge. This is Followed by Careful Inspection for Defects

Grinding a Ball-Bearing Race on an Aircraft Engine Part

A RACE for ball bearings is ground on torque-indicator arm supports for airplane engines in one of the plants of the Wright Aeronautical Corporation by employing Van Norman radius grinding machines in the manner shown in the accompanying illustration. The race is ground to a radius of 0.197 inch with a wheel that is trued on the edge to the required form. During the operation, the work is revolved at about 100 R.P.M., and at the same time is swiveled back and forth through an arc of 180 degrees on the edge of the grinding wheel. The grinding operation is performed after the torque-indicator arm supports have been hardened, the ball race itself having been rough-turned previous to the heat-treating operation.

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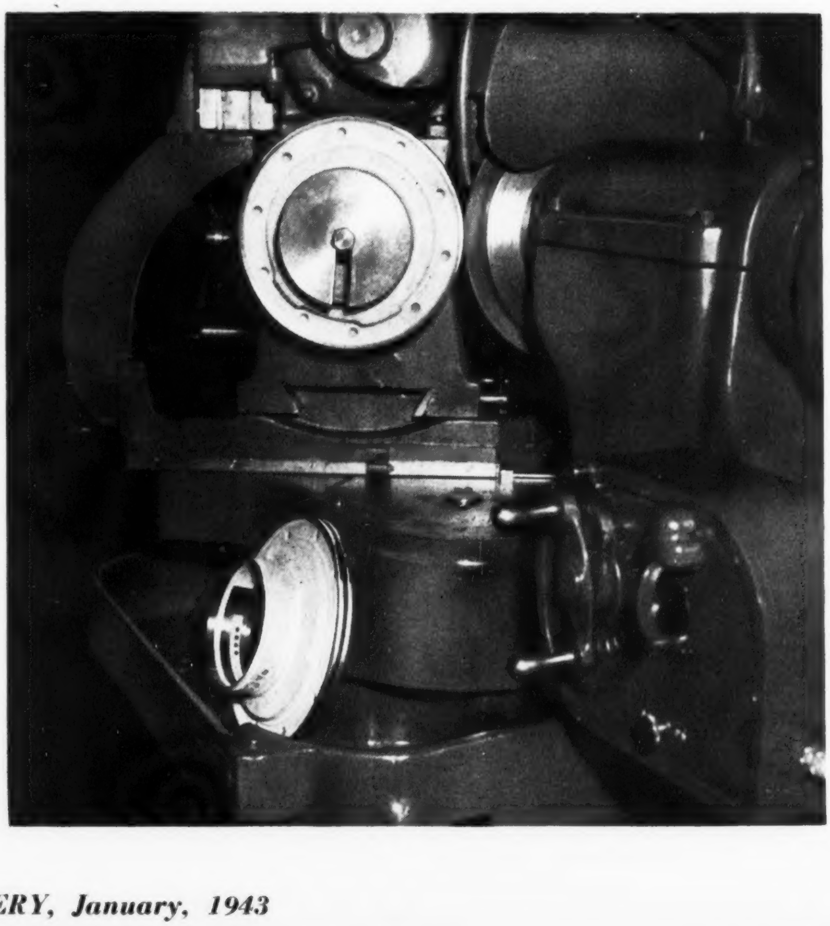
Grinding a Ball-bearing Race around Torque-indicator Arm Supports by Employing a Machine that is Provided with a Swiveling Work-head



Gages in War Production

A Brief Account of the Expansion of the Gage-Making Industry in Response to the Urgent Needs of Armament Production

By Lieutenant-Colonel H. B. HAMBLETON
Chief Gage Section, Ordnance Department, U. S. Army, and
Lieutenant-Colonel D. A. LENK
Chief Gage Facilities Section, Ordnance Department, U. S. Army

THE importance of gages in the production of war equipment is fully appreciated by men engaged in the mechanical industries. What is not so generally understood, however, is the extent to which every part and dimension must be gaged in order to assure the complete interchangeability that is the fundamental requirement in all equipment for waging war. This demand for interchangeability, in turn, calls for a greater precision than would otherwise be required.

Consider tanks as an example. Every part made by each of the manufacturers who produce medium tanks must fit every other medium tank. Hence, the control of accuracy must be carried to extreme limits, in order that this "perfect"

interchangeability may be achieved. This interchangeability also makes possible successful sub-contracting, which is necessary if we are to utilize our full productive capacity. It is only through the use of gages that the prime contractor can be assured that the parts made by one sub-contractor will fit and interchange with those made by other sub-contractors or by the prime contractor himself.

In the making of a medium tank, seven thousand different manufacturing gages are required. For the inspection, three thousand gages are used. When we consider that every one of the hundreds of pieces of equipment built for the Army and Navy requires an equal degree of accuracy, the great number of gages needed may be comprehended.

Another and perhaps even more important function of interchangeability is that every piece of ammunition must be identical with every other piece of the same kind of ammunition, so that it will not only fit the chamber of the rifle or gun in which it is to be used, but also reach its target when fired. Hence, ammunition must be made with the greatest precision, in order to function properly in automatic and other weapons and to insure accuracy in the flight of the projectile. Muzzle velocity, gravity, and air resistance, all influence the flight of the projectile; and to insure uniform results, the size, shape, and weight of every projectile must be as nearly alike as it is practically possible to make them.

The preceding paragraphs give an idea not only of the need for accurate gages, but also of the great number of gages required for the manufacture of war material in thousands of factories throughout the country. Obviously, at the beginning of the present emergency, we were faced with the prospect of a serious bottleneck in gages. The capacity of the gage industry was only a small fraction of the potential war requirements. To some extent, these needs were anticipated by work done in the arsenals. For the last twenty years, the six ordnance arsenals, limited though they were by peacetime appropriations, devoted a major part of their efforts to the preparation of gage designs and to the making and storing of a limited but vitally important accumulation of gages.

In the early stages of the defense program, this planning enabled the arsenals, which had been the sole source of ordnance during the previous twenty years, to immediately supply private manufacturers with many of the necessary working and inspection gages, so that they could begin volume manufacture of guns and ammunition. For example, Frankford Arsenal was able, during each of six months, to ship more gages to the thirteen regional Ordnance Offices for the inspection of new ordnance material than had been shipped during the entire first World War period.

In addition to the arsenal gage program, there had been established gage laboratories at leading universities located close to the thirteen Ordnance District Offices. The object of these laboratories was to inspect gages used by Gov-

Fig. 1. Laboratory Precision Gage-blocks and Measuring Instruments Used in the Final Checking of Gages

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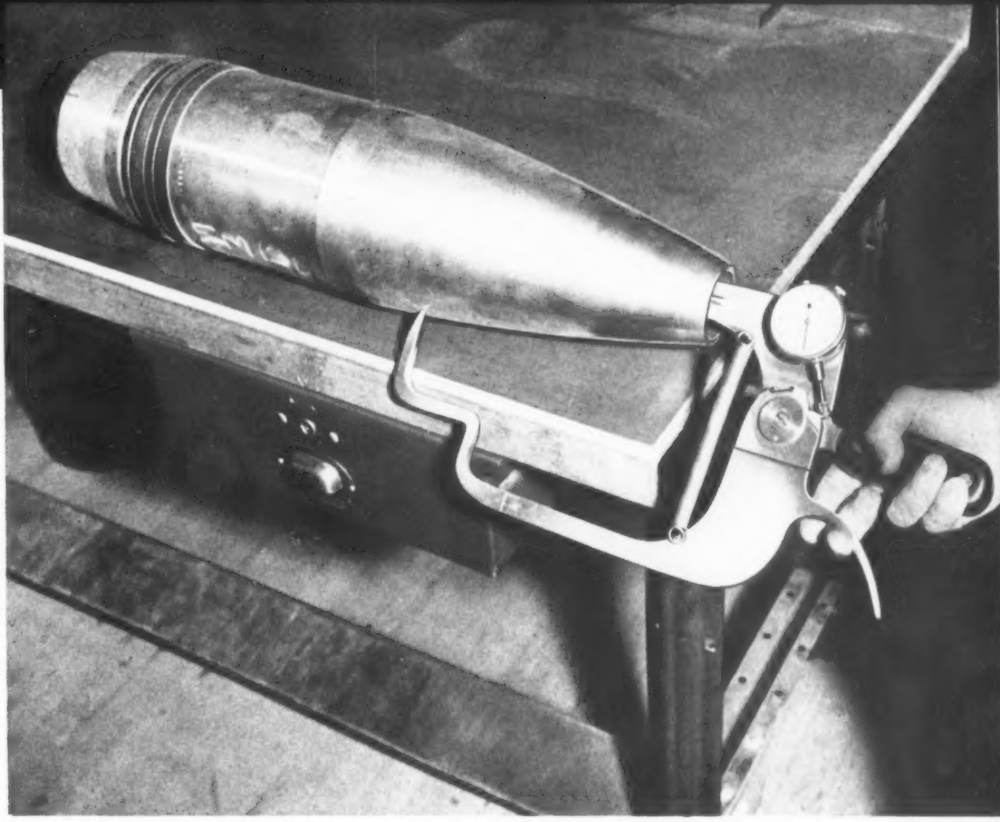

Fig. 2. Gage Designed for Measuring the Wall Thickness of a 155-millimeter Shell

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ernment inspectors and manufacturers to insure their continued accuracy. The first of these laboratories was established at Stanford University in 1930.

When the Ordnance Department of the Army, early in 1940, foresaw the tremendous demand that would be made upon the gage industry of the nation, plans were made to expand these gage-making facilities. Prior to 1939, it is estimated that the gage industry, in meeting peacetime demands, had an annual output of about \$3,000,000 worth of gages. By the end of 1939, the industry had already expanded considerably, largely as a result of orders placed in this country by Great Britain and France.

In the summer of 1940, a detailed survey of Army, Navy, and Air Corps gage requirements had been made by a consulting gage engineer lent to the Army Navy Munitions Board by one of the nation's leading gage manufacturers. This survey indicated the necessity of immediate action. In September, 1940, the leading gage manufacturers were asked to come to Washington for a meeting, when the potential gage needs were laid before them. The amounts estimated were staggering, and implied an immediate program for procurement of machine tools and delicate measuring instruments, difficult even then to obtain. In addition, the plan presented the task of developing over night skilled working forces for the completion of the program.

One difficulty facing the industry in carrying out the expansion plans was the fact that the Government procures gages on competitive bids; therefore, the Government was unable to promise business to any particular manufacturer, and the gage industry had to contemplate the expansion with the full knowledge that the new plants would have to be kept busy by obtaining orders from the defense industries in the open market. Nevertheless, the industry promptly responded to the Government requirements for a large expansion program.

The new facilities were provided partly by using Government funds for both the added plant space and machinery. But to a large extent, the manufacturers provided new facilities of their own. In all, 104 expanded gage plants are now meeting the gage demands of the war program. The cost to the Government of the expansion has been about \$18,000,000, a small fraction of the expenditures for other armament-manufacturing facilities. As a result of this expansion, today any one of the leading gage manufacturers is producing more gages than the entire gage industry of the country produced under normal peacetime conditions.

On October 15, 1940, President Roosevelt approved the initial phase of the gage facilities expansion program. Contracts were quickly negotiated, and work on the new plants was started at once. One manufacturer had held a pile driver ready to start as soon as the contract was signed, and the first pile was driven within twenty-four hours. Another had complete orders for materials and equipment ready, and orders were released by his purchasing department immediately upon the approval of the

Government contract. The response of the industry was of the highest caliber. Without its wholehearted support, our entire armament program would have been seriously impaired.

The speed with which the new gage-making facilities were completed was encouraging. The first plants were placed in production within five and one-half months after the approval of the contract. Additions have recently come into production. New working forces have been trained, and mass production methods for gage manufacture have been inaugurated.

The expanded facilities have made possible the training of a new generation of gage-makers. Under this training program, young men are carefully selected, attention being given to mechanical aptitude, eyesight, judgment, character, and even family background. One leading company is so severe in its requirements that only six out of every one hundred applicants are accepted. By new methods of training, these young men are able in a short time to perform specialized operations in gage manufacture with the same precision as the old-timers.

This, briefly, is the story of the development of the American gage industry to meet the exacting demands of war equipment manufacture for insuring a speedy and decisive victory.

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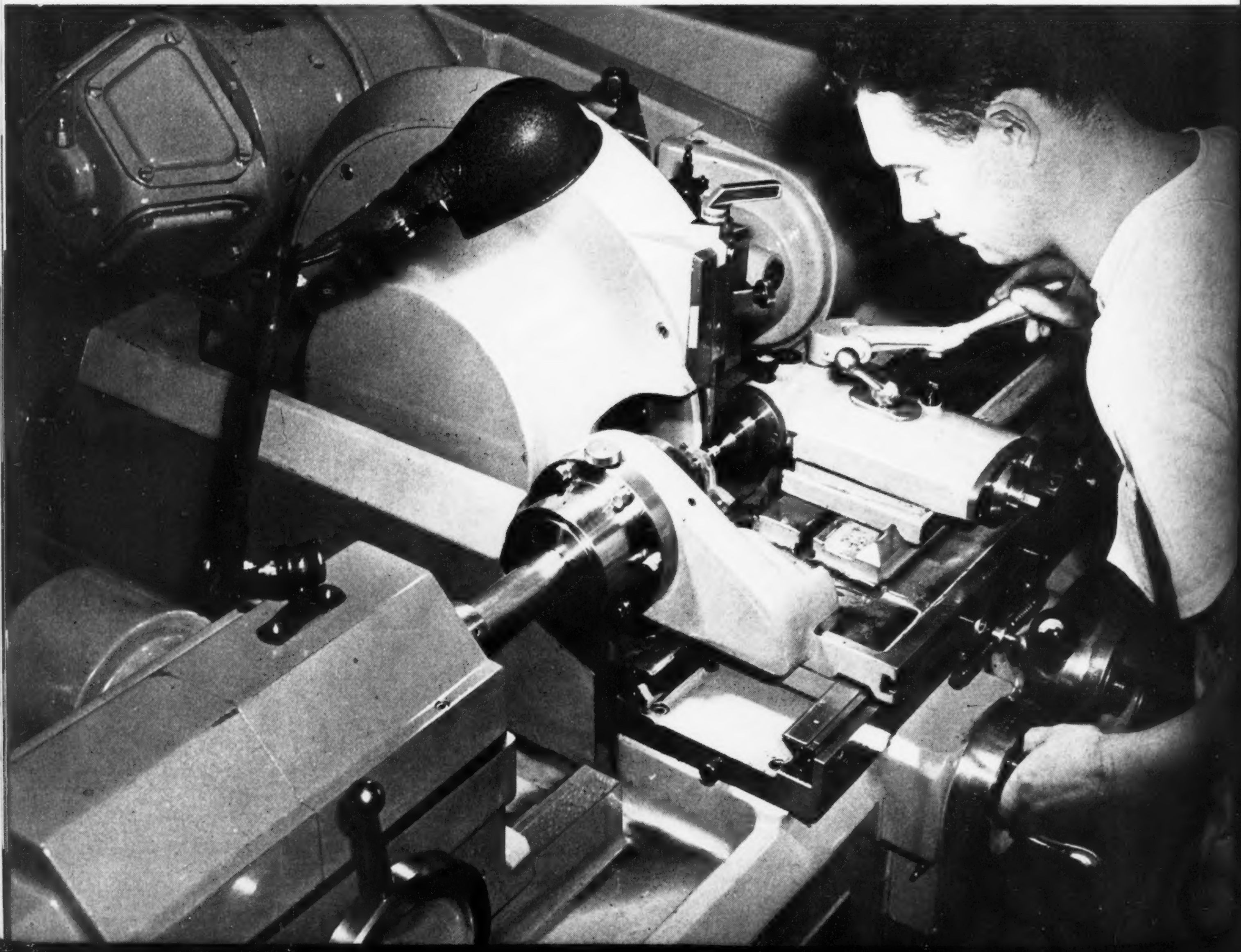
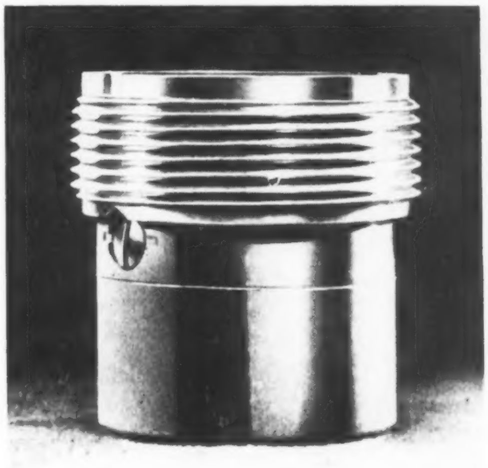
Fig. 3. Gage Grinding in One of the Recently Expanded Gage Plants



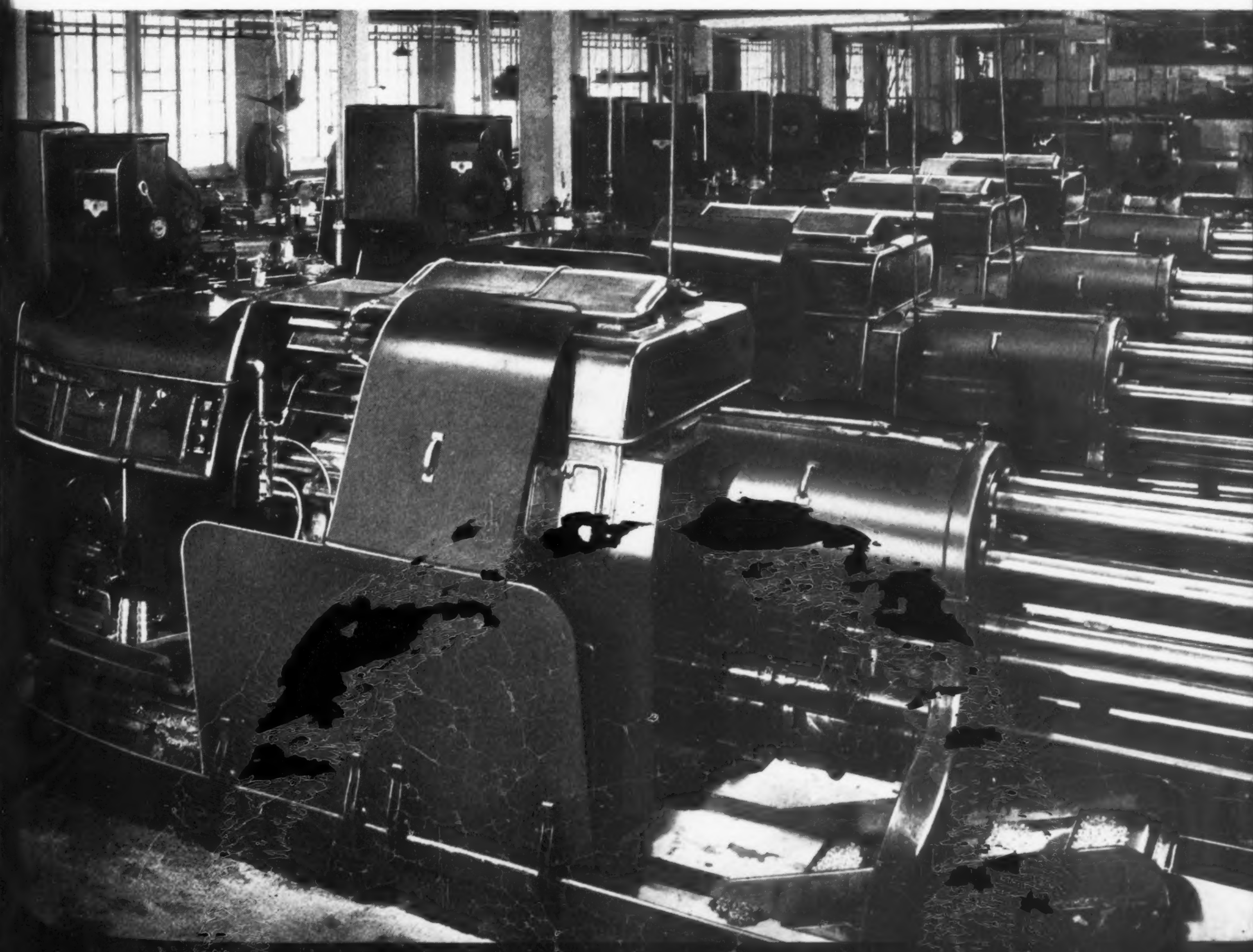
Manufacturing Boosters for High-Explosive Shells

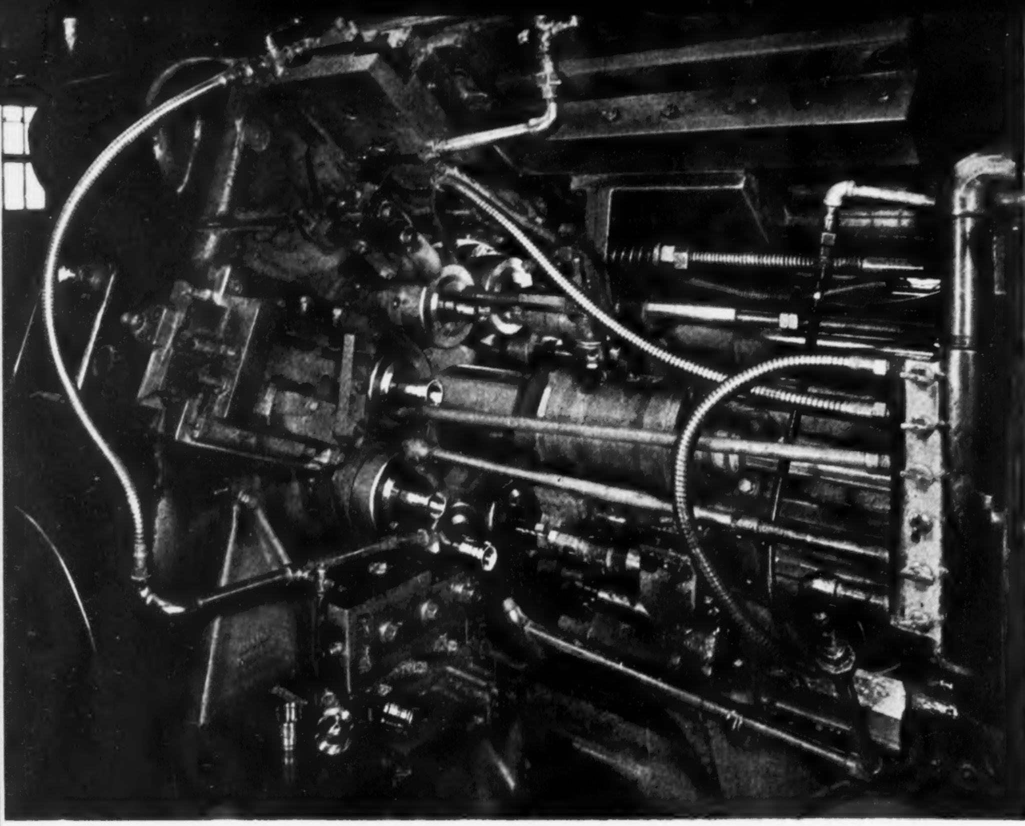


By J. B. NEALEY
Ordnance Department, Washington, D. C.

EXPLOSIVES are designed to do various types of work, just as machines are. For instance, gunpowder for use as a propellant must be of the slow burning type, so that it will continue to expand during the entire travel of the projectile through the gun barrel. A too sudden expansion would burst the gun. On the other hand, quick detonation is demanded of a high-explosive; TNT and amatol are the chief explosives used for this purpose. They are comparatively inert, and require, besides the fulminate of mercury igniter, a booster charge.

Therefore, in a high-explosive shell we have an explosive train, including the primer or detonator, the booster, and the bursting charge. The instant of detonation is controlled by the fuse, which may be either of the time or contact type, and which is screwed to the shell. The primer is located in the fuse, and some fuses carry the booster charge. However, many types of shell carry the booster charge in a separate casing or cup which is screwed on the shell, the fuse, in turn, being screwed into the booster. The insensitivity of the high explosive filling the





WAR PRODUCTION

Fig. 1. Front View of Eight-spindle Acme-Gridley Automatic Tooled up for Making Booster Bodies

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shell is a valuable characteristic, making for comparative safety in shipment. Hence, shells are shipped separate from their fuses and boosters and are assembled later to meet the military requirements.

The booster dealt with in this article consists of a cup to hold the tetryl, and a body, the cup being screwed into the body. The body has both internal threads into which the fuse is screwed and external threads for screwing the booster into the shell (see illustration at the top of page 129).

An eccentric hole is drilled or countersunk in the booster, and in the bottom of this hole and through the body is drilled a fire-hole through which the tetryl is detonated by the fuse igniter. The details of the safety design devices cannot be described for military reasons. However, it is the machining practices employed in making the booster body that are the subject of this article.

The raw material for this booster is half-hard (preferably annealed) common brass, which comes in rods. While the booster is composed of a number of pieces, the main part is turned out in quantities on automatic screw machines; Figs. 1 and 2 show an eight-spindle 2 5/8-inch Acme-Gridley machine. Each of the eight working spindles has a collet chuck, and eight bars are worked on simultaneously. The order of operations is shown diagrammatically in Fig. 3.

The first operation is performed in the eighth position, or at the lower rear spindle, where the stock is fed in. A drill mounted in the tool turret drills the large hole in the rod to the correct depth. At the same time, the outside diameter is rough-formed and the outer end chamfered. The forming is done by a circular forming tool

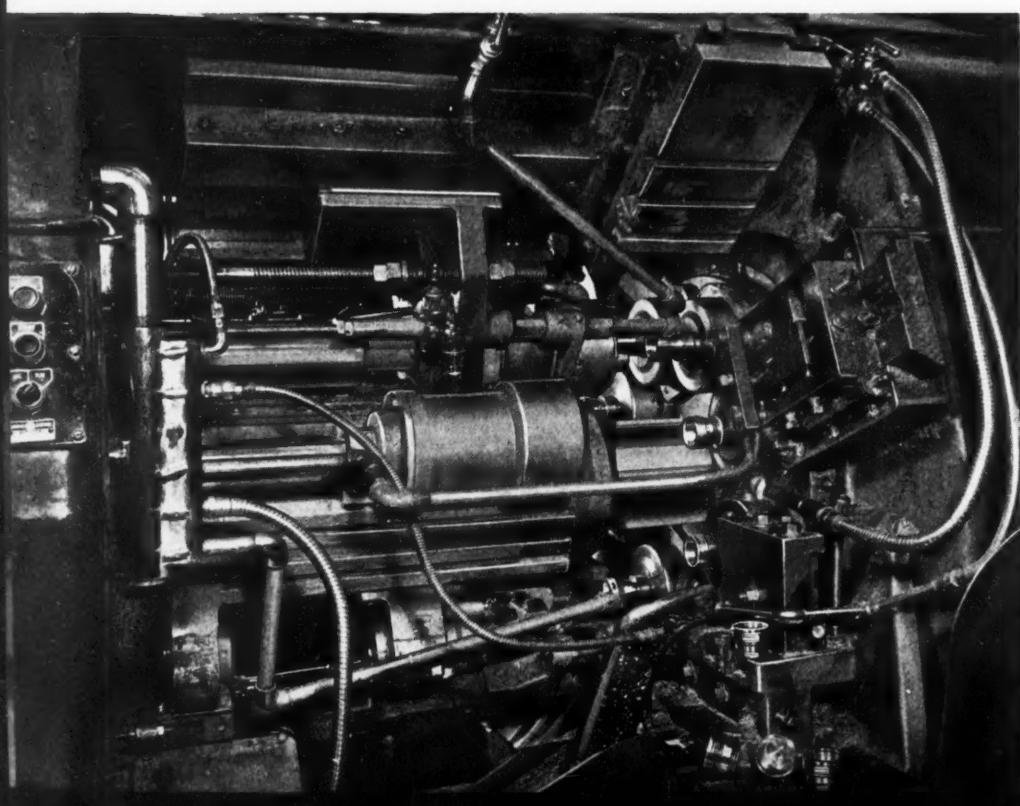

Fig. 2. Rear View of Machine Shown in Fig. 1 Tooled up for Making Booster Bodies

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mounted on the lower [illegible] slide. The cutting speed is 382 F.P.M. at a diameter of 2 inches, with the work-spindle rotating at 728 R.P.M. The tool turret feeds the drill 0.009 inch per revolution.

The second operation takes place after indexing the spindle carrier from the eighth to the first position. The operation performed in this position includes squaring the bottom of the hole, chamfering the inside of the outer end, and turning the outside diameter at the outer end with a knee-turner mounted on the turret-slide. At the same time, the outside diameter at the rear is finish-formed with a dovetail forming tool mounted on the first-position forming slide.

In the third operation, the small hole is drilled, using an air drill to obtain the high speed necessary. At the same time, the end is finish-faced with a knee-turner mounted on the turret-slide. The small drill starts in the center point left by the large drill in the eighth position, so that the holes will be concentric with the outside diameter.

In the fourth operation, an eccentrically located hole is drilled. There are several ways of tooling up for this operation, one of which consists of employing a spindle driven through friction disks, so that the spindle can be stopped by means of a brake while an auxiliary spindle on the tool-slide does the off-center drilling. However, a unique method may be used, eliminating the stopping of the spindle and drilling the eccentric hole during the rotation of the work-spindle.

The turret-slide carries a quill driven on the center line; a separate sleeve is mounted in the housing fastened to the turret-slide and is located eccentrically relative to the center line. The driving spindle for this eccentric drilling attachment rotates at the same speed as the work-spindle and in the same direction. The drill-holder is mounted on ball bearings, front and rear, in an off-center position corresponding to the amount of eccentricity required. The cutting is done by a flat drill, which is ground to the

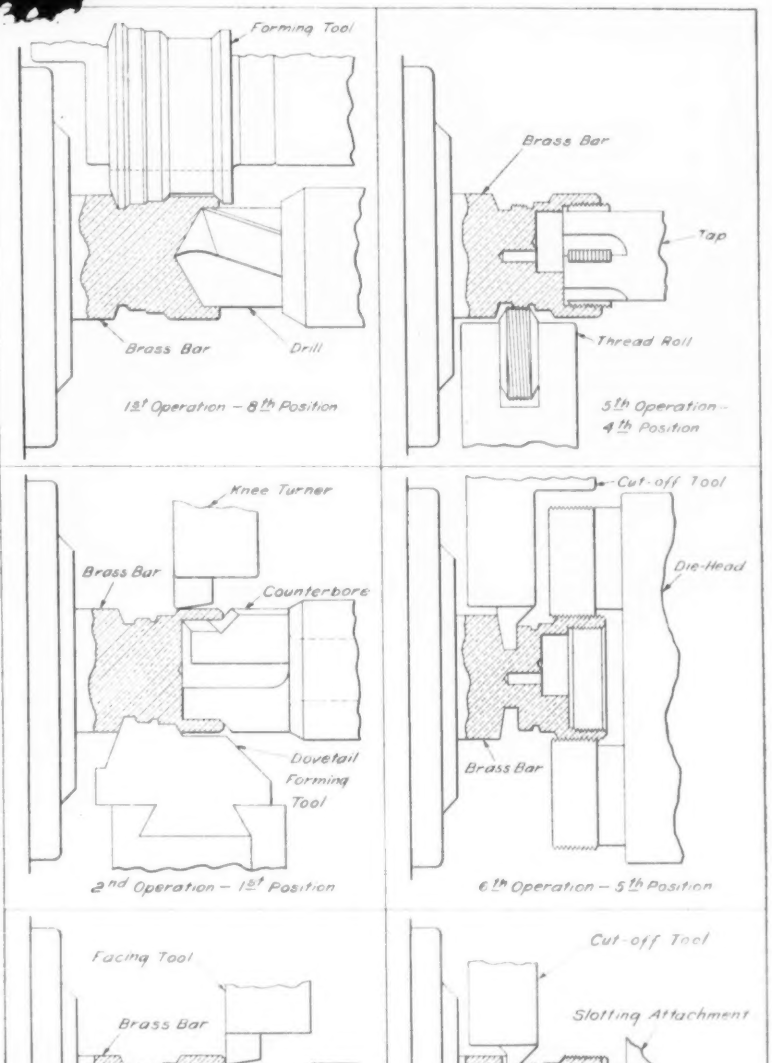

Fig. 3. Diagram of Tooling Arrangement of the Acme-Gridley Machine Shown in Figs. 1 and 2

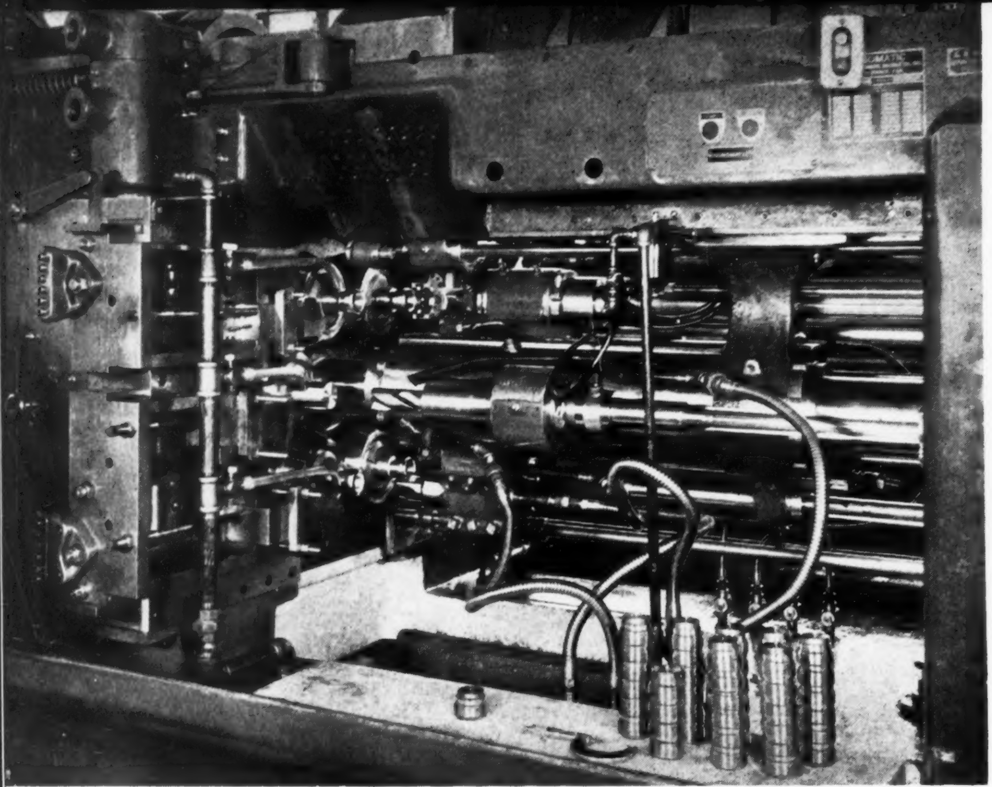

Fig. 4. Front Side of Six-spindle Conomatic Tooled up for Making Booster Bodies, Showing Eccentric Drilling Attachment Indicated in the Fifth Position in Fig. 8

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exact shape of the bottom hole and is carried by this rotating drill-holder. The differential speeds between the work and the drill are effected by a gear integral with the drill spindle, which meshes with a fixed internal gear concentric with the main quill, which is held securely in the housing. The same operation can also be performed by an eccentric drilling attachment, eliminating the internal gears.

When a geared head is used in connection with the eccentric drilling attachment, the work revolves at 700 R.P.M. and the drill at 838 R.P.M. When the eccentric drilling attachment is used without a geared head, the drill is held stationary, and the cutting speed of the drill is, therefore, the same as the speed of the work-spindle—namely, 728 R.P.M.

In the fifth operation, a thread is tapped on the inside of the large bore with a collapsible tap held in a standard threading attachment. The unit is mounted on a separate slide, directly above the turret-slide. It is driven by a jack-shaft inside the gear-box, and the cutting speed of the threading spindle is approximately one-seventh that of the work-spindle. While cutting the internal thread, a thread is rolled on the outside diameter, close to the back end of the booster. For this operation, a single-thread roll is provided, which is mounted on the front top slide. The roll is free to turn, and rotates with the work through frictional contact with the outside of the work-piece.

The sixth operation consists of cutting the outside thread on the front end. For this operation, a 2 3/8-inch self-opening die-head is employed. This die-head has ground-thread circular chasers, is mounted on the threading attachment above the turret-slide, and is driven from

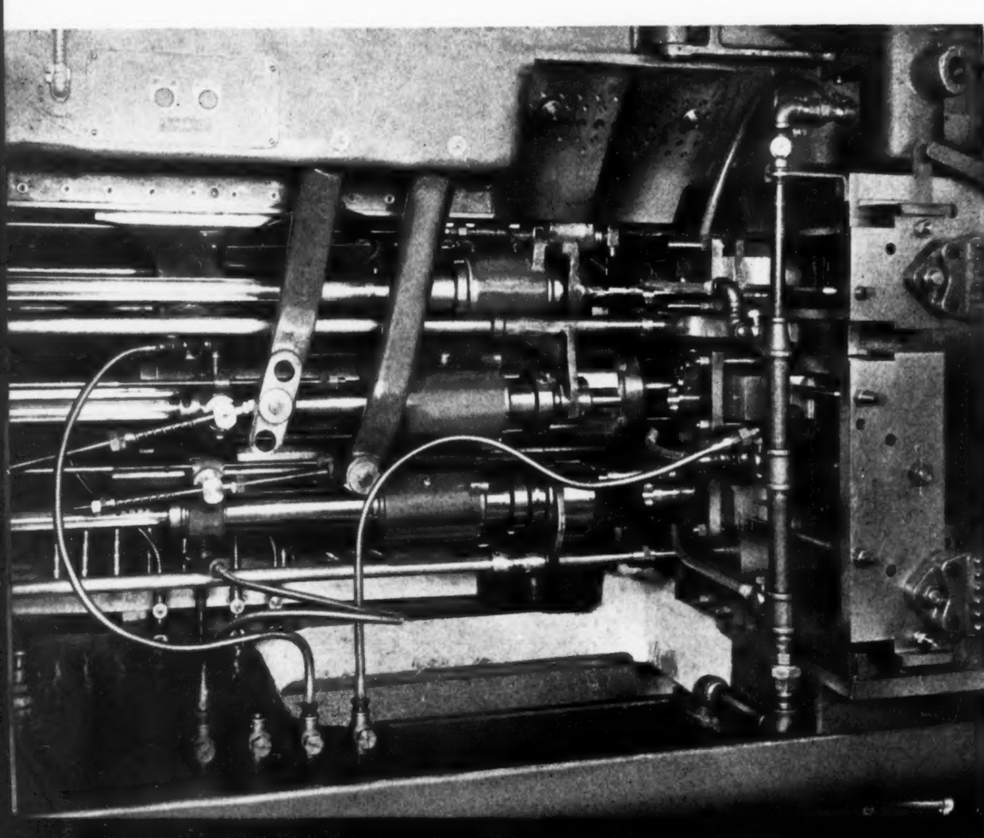

Fig. 5. Rear Side of Conomatic Shown in Fig. 4, Tooled up for Making Booster Bodies

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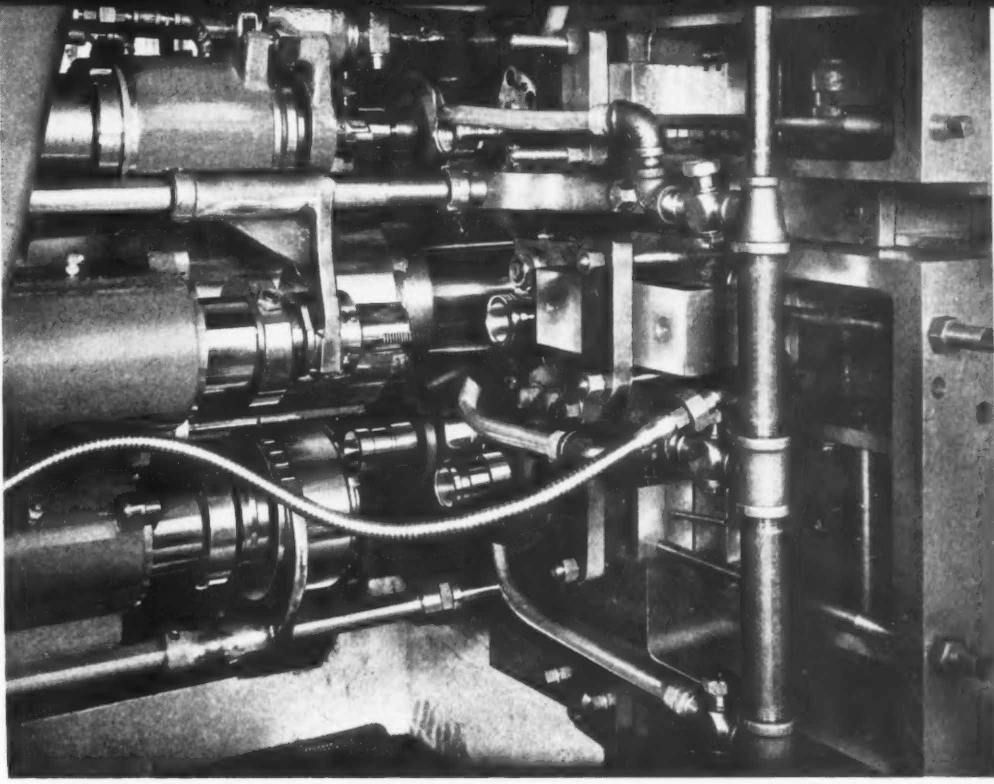

Fig. 6. View of Conomatic Showing Eccentric Drilling Attachment in Fifth Position, Collapsing Tapping Attachment in Fourth Position, and Automatic Die-head in Third Position

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a jack-shaft. While the threading is being performed with the die-head, a breakdown tool cuts the piece part way from the bar. This breakdown tool is mounted on the rear top slide.

In the seventh operation, the open end of the booster is slotted with a special attachment rotating at the same speed and in the same direction as the work-spindle. This attachment is provided with two fish-tail tool bits, held in a dovetail slide which is mounted in an auxiliary spindle. The auxiliary spindle is mounted on the turret-slide, and is driven directly from the main drive-shaft. The tool bits and dovetail slide are given a reciprocating motion by a pair of opposed roller contacts engaging an eccentric raceway. The forward movement of the tool is controlled by the movement of the main turret-slide.

In the eighth operation, the piece is cut off from the bar completely. The cut-off tool is mounted on top of a double-decker tool-holder, which holds the forming tool in the eighth position for rough-forming the outside diameter in the first operation.

The booster body is then thoroughly cleaned; and after all burrs have been removed, each component of the booster is carefully inspected by both factory and Government inspectors. A few minor operations are required to complete the booster body before it is ready for assembly.

While this detailed explanation is based on an eight-spindle Acme-Gridley automatic machine, the same part is also made in large quantities on six-spindle Acme-Gridley machines, which perform exactly the same operations, with the exception of the slotting. The spindle speeds and other data are exactly alike. When this type of machine is employed, the slotting is done as a

Fig. 7. Close-up View Showing Completed Work in the Sixth Position previous to being Cut off

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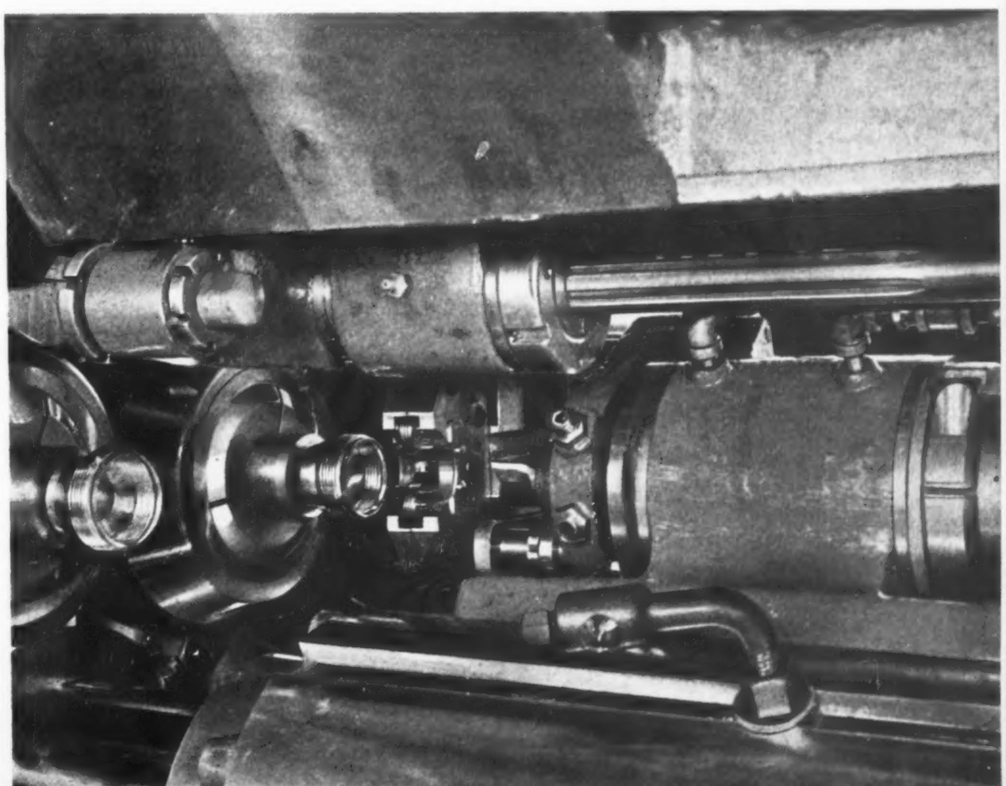


second operation on another type of machine.

While it is often the practice to run round bar stock through a special machine that turns the full length preparatory to machining the bars in automatics, this is confined to hot-rolled material. It is not the practice on cold-rolled stock or on brass.

Most automatics are provided with collets which hold bars within varying tolerances up to 0.020 inch (+ 0.010 inch and — 0.010 inch). Bars are usually purchased for the machines that are within the 0.020-inch tolerance. The diameter of the stock, of course, depends principally on the requirements for the finished work.

Making Boosters on Conomatics

Another well-known machine that is employed extensively in the manufacture of ordnance items is the Conomatic. The following description refers to the six-spindle Conomatic, but the booster made is identical to the one already described.

This machine is so constructed that the revolving tool-heads can be used either with independent speeds or speeds synchronized with the speed of the work-spindle. The speed of the work-spindles in the machining of the booster body is 619 R.P.M., and the cutting speed is 326 F.P.M. The actual machining time is 8 seconds, which, plus the idle time of 4 seconds, gives a production time of 12 seconds per piece.

The draw-in type of collet chuck in each spindle is operated automatically to allow the bar stock to move forward the proper feeding distance when the spindle is indexed to the feeding position. The feeding takes place in the sixth position, which is located at the upper front portion of the machine.

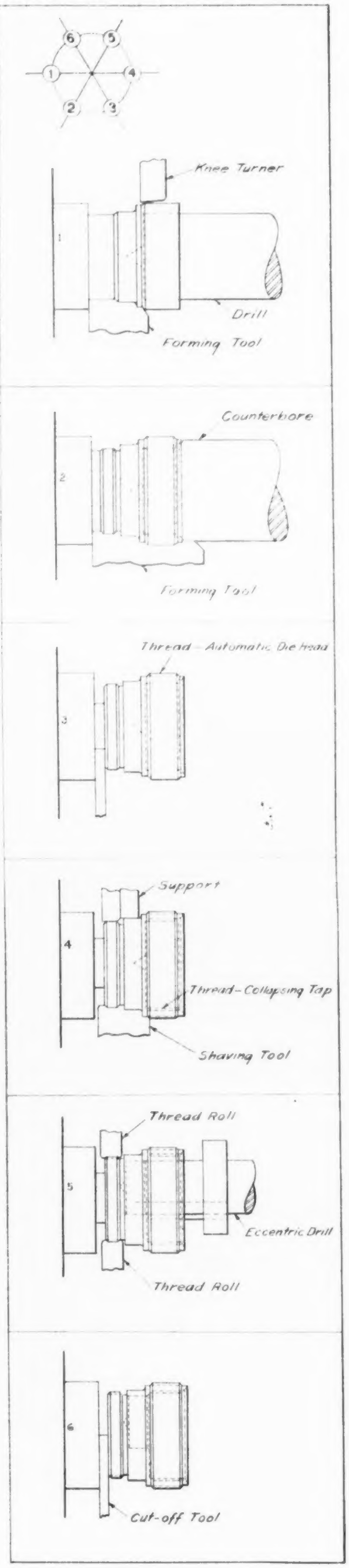


Fig. 8. Tooling for Making Booster Bodies on a Conomatic

At this station, the stock is thrust forward against a pivoted stop as the collet opens, and is held firmly as the collet closes again. The stop then swings out of the way, and the work-spindle carrier indexes in a clockwise direction, presenting the bar in the first position (see Fig. 8) to a drill mounted on the main end-working tool-slide. This drill is revolved at 450 R.P.M. in the opposite direction to the work-spindle, which gives it a relative speed of 1069 R.P.M.

On the main tool-slide in the same position is a knee-turner which takes a light cut on the bar for a short length, equivalent to the width of the front outside thread. At the same time, a forming tool on the cross-slide takes a forming cut on the remaining outside surface.

In the second position, a counterbore on the main slide finishes the hole drilled in the first station, and another cutting tool on the cross-slide further forms the outside surface of the booster. Eleven surfaces are cut by this tool.

Threading of the front end of the booster is done in the third station by chasers in a revolving, self-opening die-head mounted on a revolving spindle on the main end-working tool-slide, but advanced independently of the tool-slide through a lever, cam, and roll. The die-head revolves in the same direction as the work-spindle, but at a diminished speed. In the same position, the cross-slide advances a blade type tool, which partially severs the booster from the stock.

In the fourth station, a collapsible tap cuts the inside thread of the booster, and a shaving form tool is advanced by the cross-slide to finish the surface of certain diameters that were rough-formed in the first and second stations. The shaving tool is held in an attachment with a roller that supports the work.

At the fifth station, an eccentric hole is countersunk in the bottom of the hole that was drilled and counterbored in the first and second stations, respectively. For this purpose, an eccentric hole-drilling attachment of ingenious design is used. In this position, a thread is also rolled on the outside of the booster at the rear. In the sixth position, the booster is cut off.

* * *

Grinding Axles for Diesel-Electric Locomotives

The illustration below shows the grinding of axles for Diesel-electric locomotives built at the Erie Works of the General Electric Co. The small-diameter journals at the ends and the adjacent larger diameter wheel fits are ground to size within plus 0.000 minus 0.001 inch on a Norton cylindrical grinder. The main body of the axle between the wheel fits, which is 8 1/16 inches in diameter, is ground to a tolerance of plus or minus 0.005 inch. The fillet between the large and small diameters is also ground at each end, one side of the grinding wheel being dressed to suit the shape of the fillet. About 0.005 inch of stock is left in the rough-grinding operation for finish-grinding. The axle is reversed in the machine to grind the other end.

Results Obtained in Scrap Drive

As an indication of what a single company can accomplish in the drive for scrap, the results obtained by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., may be mentioned. In the last six months this company has collected approximately 925,000 pounds of cast iron and steel scrap, 12,300 pounds of brass, 2000 pounds of lead, 1100 pounds of copper, and 2400 pounds of aluminum, in addition to various other scrap materials such as burlap, rags, and paper.

In several instances, the cost of removing the obsolete equipment and metal was more than the salvage value, but no attention was paid to this cost in the effort to make every possible contribution to the nation's scrap pile. It should be particularly noted that a scrap drive is a job that is never finished. If management and employes both are alert, additional scrap will be uncovered almost every day.

* * *

The net income of American railroads for the first ten months of 1942 was about $707,900,000. During the same period, taxes paid by the railroads were over $1,000,000,000—the taxes exceeded the net income by about 45 per cent.

The Wheel Fits and Ends of the Axles for Diesel-electric Industrial Locomotives Built by the General Electric Co. are Ground to a Tolerance of 0.001 Inch

Boring Mine Car Wheels to Receive Roller Bearings

Mine cars of all-steel construction are produced in large quantities by the Huntington, W. Va., Works of the American Car and Foundry Co. The wheels for these mine cars must be bored to limits of plus or minus 0.001 inch, ready for the insertion of two roller bearings, one in each hub. This boring operation is performed on a Bullard vertical turret lathe equipped as shown in the accompanying illustration. The hub on one side is rough- and finish-bored before the wheel comes to this vertical turret lathe, so that the wheel can be accurately seated on a mandrel which engages the finished bore.

Machining Mine Car Wheels Accurately to Receive Timken Tapered Roller Bearings on a Bullard Vertical Turret Lathe

In the vertical turret lathe operation, four tools on the turret are employed and two on the side-head. First, the tapered gouging type of cutter seen on the turret at the upper left breaks the metal at the edge of the bore. Then the bore is rough-machined by a second tool on the turret, after which it is finish-bored by the tool on the Davis boring-bar, which is directly above the work. Finally, the tool in the lower left turret station is used for counterboring.

One of the cutters on the side-head is used for facing the end of the hub, and the second tool for machining an internal groove to receive a retaining spring for the hub cap. The bores have a nominal diameter of 4 7/16 inches. They are separated in the middle of the wheel by integral collars.

Behavior of Cast Iron at High Temperatures to be Studied

The War Production Board has approved a field research project to study the possibility of utilizing cast iron for work where temperatures exceeding 450 degrees F. are encountered. The research program is being conducted by the War Metallurgy Committee of the National Academy of Sciences, 2101 Constitution Ave., Washington, D. C., with the cooperation of the American Foundrymen's Association. T. E. Barlow, of the Vanadium Corporation of America, and C. O. Burgess, of the Union Carbide and Carbon Research Laboratories, have been appointed to make the study. Since time is vital in this project, the object of which is to encourage the use of readily available substitute materials whenever possible, these men have requested the cooperation of industry.

Information relating to specific applications in which cast iron is being, or has been, used, successfully or otherwise, at temperatures above 450 degrees F. is requested. The information sent to the investigators will be kept confidential if so requested. Engineers, foundrymen, field service men, and others who have information on performance records of cast iron at high temperatures can make a valuable contribution to the war effort by cooperating in this work. Detailed information or suggestions as to possible sources of information should be sent to either T. E. Barlow, 2440 Book Bldg., Detroit, Mich., or C. O. Burgess, 4625 Royal Ave., Niagara Falls, N. Y.

* * *

Drilling Deep Holes in Magnesium Alloys

At the recent annual meeting of the American Society of Mechanical Engineers, W. W. Gilbert, of the University of Michigan, and A. M. Lennie, of the Dow Chemical Co., presented a paper on the drilling of deep holes in magnesium alloys which gave, in great detail, the results of painstaking experiments in magnesium drilling. This paper is available by application to the American Society of Mechanical Engineers, 29 W. 39th St., New York City. It covers the equipment and methods by which the tests were carried out, and gives the results of tests with many different types of drills. The paper brings out the fact that the standard twist drill does not give best results in magnesium deep-hole drilling, changes being required in the helix angle and the drill-point angle. The feeds and speeds most advantageous to employ are specified. Numerous illustrations and diagrams are included to illustrate the conclusions reached by the investigators.

MACHINERY'S DATA SHEETS 481 and 482

RECOMMENDED TOOL ANGLES, FEEDS, SPEEDS, ETC., FOR MACHINING WITH CEMENTED-CARBIDE TOOLS—3

Material	Brinell Hardness	Clearance, Degrees		Top Rake, Degrees	Depth of Cut, Inch		Feed, Inches per Rev.	Speed, Surface Feet per Min.		Remarks
		Front Tool Angle	Side Tool Angle		Roughing	Finishing		Roughing	Finishing	
Steel, Alloy	300	4–6	4–7	0	1/32	—	0.018	—	400–600	Tensile strength up to 180,000 pounds per square inch
Steel, Alloy	300	4–5	4–5	—2	1/8	—	0.022	300–600	—	
Steel, Alloy	300	3–4	4	—2	1/4	—	0.022	350–600	—	
Steel, Alloy	300	3–4	3–4	—2	3/8	—	0.022	300–450	—	
Steel, Alloy	341	3	3	—4	1/2	—	0.022	275–400	—	
Steel, Alloy	341	2	2	—4	1/2	—	0.022	275–350	—	
Steel, Alloy	341	2	2	—4	5/8	—	0.022	250–300	—	
Steel, Alloy	550	4	4	—4	1/32	—	0.022	300–400	—	Tensile strength 200,000 to 285,000 pounds per square inch
Steel, Alloy	550	4	4	—4	1/8	—	0.024	300–450	—	
Steel, Alloy	550	4	4	—4	1/4	—	0.022	250–350	—	
Steel, Bearing ...	190–220	5	7	—4	1/4–3/8	—	0.022	300–350	—	(S A E 52100)
Steel, Bearing ...	190–220	4	4	—4	3/32	0.020	0.022	450	600	(S A E 52100)
Steel, Bearing ...	190–220	Form Tool Boring		—4	—	—	0.007–0.002	—	285–400	(S A E 52100) (Grooving)
Steel, Carbon ...	207	4–7	4–7	0	1/16	1/32	0.022	400–1000	—	Tensile strength up to 100,000 pounds per square inch
Steel, Carbon ...	300	4–6	4–7	—2	1/8	—	0.023	400–600	—	Tensile strength 142,000 pounds per square inch
Steel, Carbon ...	300	4	4	—3	1/4	—	0.028	350–450	—	
Steel, Carbon-Vanadium	190	5	4	—2	3/16	—	0.024	287	—	
Steel, Carbon-Vanadium	190	4	4	—4	1/8	—	0.024	287	—	
Steel, Carbon-Vanadium	190	5	4	0	1/8	—	0.022	373	—	

MACHINERY'S Data Sheet No. 481, January, 1943

Compiled by C. G. Williams, Consulting Engineer
Forged Carbides, Inc., Long Island City

RECOMMENDED TOOL ANGLES, FEEDS, SPEEDS, ETC., FOR MACHINING WITH CEMENTED-CARBIDE TOOLS—4

Material	Brinell Hardness	Clearance, Degrees		Top Rake, Degrees	Depth of Cut, Inch		Feed, Inches per Rev.	Speed, Surface Feet per Min.		Remarks
		Front Tool Angle	Side Tool Angle		Roughing	Finishing		Roughing	Finishing	
Steel, Cast	212	4–6	4–6	0	1/8	0.020	0.024	350–450	400–450	Tensile strength up to 70,000 pounds per square inch
Steel, Cast	—	4–6	4–6	0	1/4–3/8	—	0.022	300–350	—	
Steel, Chromium-Molybdenum	240	4	4	—2	—	0.008	0.010	—	750	Heat-treated. Fine boring (Ford connecting-rod)
Steel, 3.5% Manganese	—	2	2	—6	3/8	—	1/32	180	—	
Steel, 12% Manganese	—	4	4	—4	1/8	0.020	0.020	100–150	150–250	
Steel, S A E 1040	—	2	2	—6	3/8	—	1/32	210	—	
Steel, S A E 1050	260–280	6	7	0	1/4	0.028	0.024	275–350	450–600	
Steel, S A E 1050	—	4	5	—	3/16	—	0.024	375	—	
Steel, S A E 2340	293	2	4	—4	3/8	1/32	0.032	385	525	
Steel, S A E 2340	241	4	4	—4	1/16	—	0.020	935	—	5-inch diam. by 68-inch piston-rod
Steel, S A E 3140	280	4	4	0	3/16	0.018	0.022	300–400	475	
Steel, S A E 3140	245	4	4	0	1/4	0.020	0.026	375–450	525	
Steel, S A E 3140	207	5	4	—4	3/8	0.032	0.024	350–400	630	
Steel, S A E 3240	288	3	4	0	1/8	0.024	0.022	375–450	565	
Steel, S A E 3240	327	4	5	0	1/4	0.018	0.022	350–450	660	
Steel, S A E 3240	340	2	2	—4	3/16	0.020	0.020	330–410	510	
Steel, S A E 3240	—	2	2	—4	0.125	—	0.024	470	—	Heat-treated (36-42 Rockwell) Intermittent cut
Steel, S A E 3340	388	2	2	—2	1/8	0.032	0.028	300–360	450	Intermittent cut
Steel, S A E 3340	319	2	2	—4	3/16	0.028	0.024	350–400	570	
Steel, S A E 3340	290	4	6	—2	3/8	0.018	0.021	330–475	690	
Steel, S A E 3435	365	5	4	0	1/16	0.032	0.022	370–450	550–750	Boring (Airplane cylinder)
Steel, S A E 3435	337	4	4	0	3/16	1/32	0.022	375	475	
Steel, S A E 3435	302	4	4	—2	1/8	—	0.022	490	—	

MACHINERY'S Data Sheet No. 482, January, 1943

Compiled by C. G. Williams, Consulting Engineer
Forged Carbides, Inc., Long Island City

Multi-Flame Jig Facilitates the Brazing of Tool Bits to Shanks

Whether or Not the Making of Solid-Shank High-Speed Steel Cutting Tools will be Prohibited Here, as It has been in England, Manufacturers of War Products will be Interested in the Brazing Method Here Described, which Makes Possible Appreciable Economies in High-Speed Steel Use

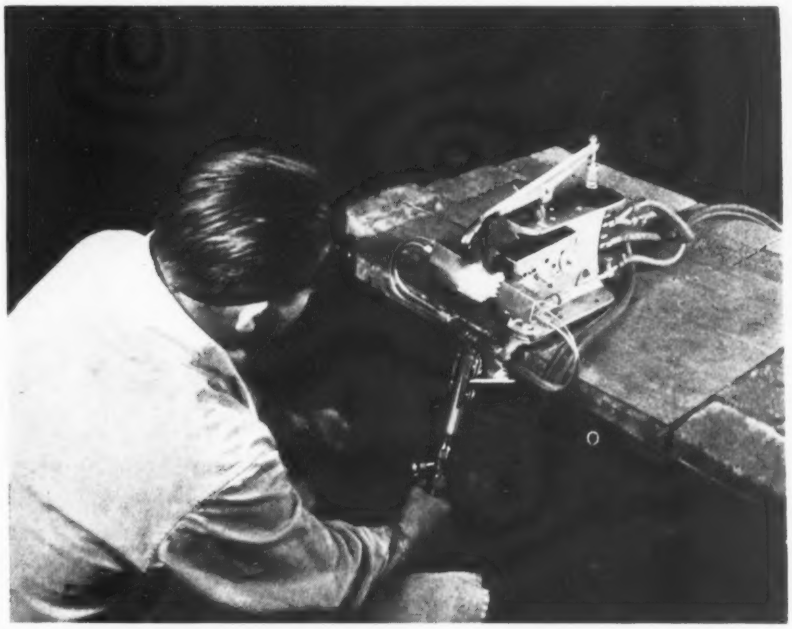


Fig. 1. Jig Used for Silver-soldering or Brazing Cemented-carbide, High-Speed Steel, and Ordinary Carbon Tool-steel Inserts to Mild-steel and Cast-iron Shanks

THE tool bit brazing jig* to be described was originally designed by A. E. Speck, of the Dominion Oxygen Co. Ltd., Toronto, Canada, for use in soldering or brazing bits made of cemented carbide to mild-steel shanks. One of the difficulties heretofore experienced has been that of sweating the silver solder or brazing alloy firmly to the cemented-carbide insert. The use of this multi-flame brazing jig has greatly facilitated the sweating action, so that even inexperienced operators can produce a firm and lasting bond.

Use of the jig was extended when it was noted that, in many plants, solid shanks of high-speed steel that were too short to be used in the tool-holder were being discarded as scrap. A few of these short lengths were obtained, and inserts about the same size as those of cemented carbide were cut out of them by means of high-speed disk grinders. These inserts were then brazed or silver-soldered to mild-steel shanks, utilizing this jig, with highly successful results. Subsequent experiment has shown that the jig can also be used to join an ordinary carbon tool-steel bit with a mild-steel shank. It may be stated here that cast-iron shanks have also been used to hold bit inserts by the Montreal Locomotive Co. with considerable economy. With this equipment, all types of bits can be joined to cast-iron shanks by silver-soldering or brazing.

Fig. 1 shows the jig as it appears in operation, and it can be seen that it affords an effective means of holding the tool-steel insert in position during the heating operation, as well as of properly distributing the heat for fusing the silver solder or brazing material without overheating the insert.

As shown in Fig. 2, a holder is provided for the tool shank, and a spring-loaded compression pin with a Stellite tip bears against the bit insert in such a way that the pressure forces the insert firmly into its recessed socket in the shank. Heat is applied by means of two seven-flame oxy-acetylene heating heads attached to a blowpipe body. A ball-and-socket joint permits the flames to be moved back and forth across both sides of the shank.

The blowpipes are ignited by a pilot light through the operation of a quick-acting valve. All oxy-acetylene equipment parts are standard units. The brazing material is in the form of shim stock, 0.003 inch thick, made from silver, brass, or deoxidized copper.

The sequence of operations is as follows: Carbon tetrachloride is used to clean the bit insert

*This jig has not been patented. Full details of its construction, together with blueprint drawings, will be made available to those interested in utilizing this arrangement. Requests may be addressed to either The Linde Air Products Co., Room 308, 30 E. 42nd St., New York City, or to its Canadian affiliate, the Dominion Oxygen Co. Ltd., Toronto, Canada.

and the surfaces and corners of the recess in which it is to be placed. A paste flux is applied to all surfaces to be brazed, and the bit is inserted in the recess with the shims in place.

The tool shank is then placed in the holder, and the pin adjusted by means of a spring tension device at the rear of the rocker arm so that it bears against the insert with a moderate pressure. It should be pointed out that one of the reasons for the successful performance of this jig is the constant pressure exerted during the heating operation by this hold-down pin.

The heating heads are now ignited, and positioned by means of the ball joint on the blowpipe handle so that the flames are directed at the side of the shank just back of the bit. The heads are then moved up and back slightly to spread the heating effect. Heating continues until the shank temperature reaches approximately 1600 degrees F., when the flames are extinguished.

At this point, the silver solder has melted and the compression pin has pressed the insert firmly into place, squeezing out the excess solder and flux to form a strong and lasting joint. A gage can then be used to check the position of the insert. The compression pin will hold the insert in the proper position until the solder sets. If there is any deficiency of solder noticeable, additional solder can be supplied during this inspection period. When the solder has hardened, the shank is placed in lime powder.

The Montreal Locomotive Co., the Canadian Car & Foundry Co., the Dominion Engineering Co., the Canadian Tube & Steel Products Co., the Canadian Ingersoll-Rand Co., and many other Canadian companies have used this type of jig with highly satisfactory results. Its operation has proved to be exceedingly rapid and economical, and the results obtained have been remarkably uniform. Practically no failures have been experienced by these companies, in contrast to a 60 per cent loss of bits due to cracking, suffered by one of these companies, when using another brazing process.

Many advantages have been noted over the earlier method of heating in a hydrogen atmosphere furnace. With that process, wires were used to hold the bit in place, but often these did not provide the necessary pressure and became loosened during heating. Also, there was no assurance that the bit inserts would be pressed firmly into position when the solder became molten, and no adjustment could be made to rectify misalignment until after the shank had been removed from the furnace.

In the case of carbon tool-steel inserts, some difficulty was anticipated, in using the new jig, due to the fact that this steel is heat-treated at a temperature which is almost the same as that required to melt the silver solder. This difficulty was solved in two different ways. The first was by using a water-cooled heat-dissipator shoe, which bears against the tool-steel insert during the soldering operation, as shown in Fig. 3, to prevent the insert from becoming overheated and being annealed. The second was by substituting a cast-iron brazing compound for the

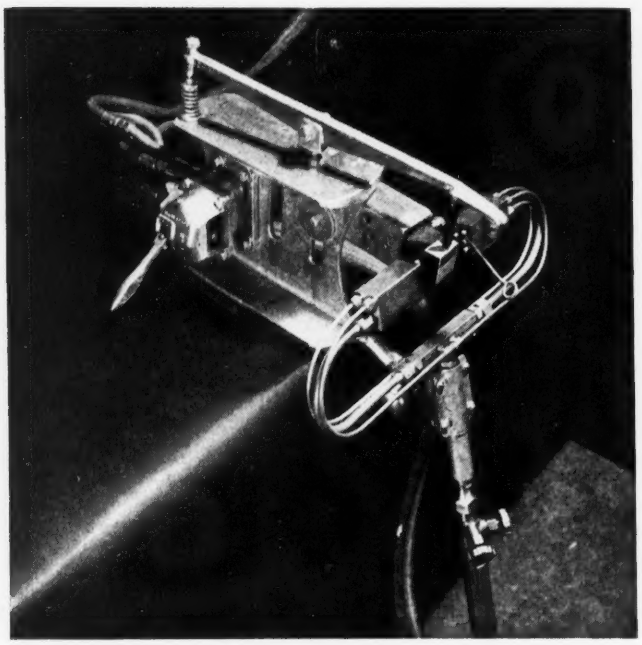


Fig. 2. A Feature of the Jig is a Stellite-tipped Pin which Presses the Insert Firmly in Place during Entire Brazing Operation. Evenly Distributed Heat is Applied by Two Seven-flame Oxy-acetylene Heads

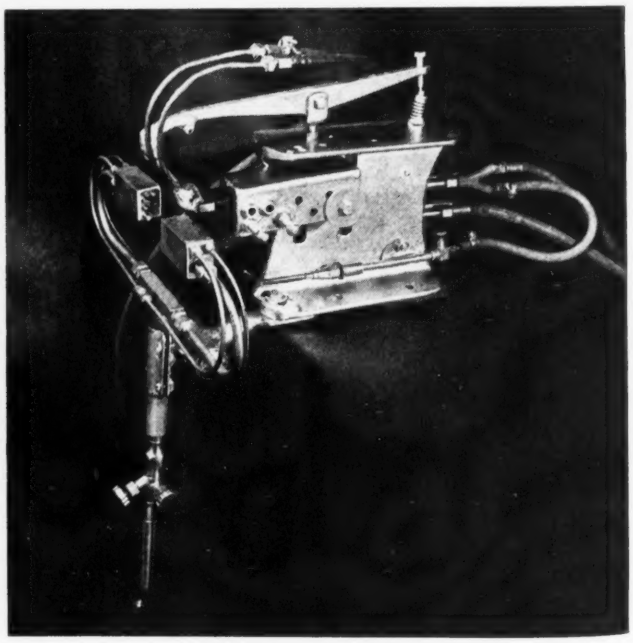


Fig. 3. To Avoid Overheating of Ordinary Carbon Tool-steel Inserts, a Water-cooled Heat-dissipator Shoe is Brought to Bear against the Insert. Heat is Applied to the Shank Directly behind the Brazing Joint

silver solder, so that the insert could be heat-treated again after bonding to the shank.

In other words, the first method was designed to maintain the original properties of the tool steel during the silver-soldering operation by keeping it below its critical temperature, while the second method permitted the tool steel to be annealed during the bonding operation, but provided a joint that would hold through the subsequent heat-treatment.

High-speed steel inserts can also be joined to mild-steel shanks in this jig by using a welding compound which has a fusing temperature of 2250 degrees F. An air quench is applied immediately after welding, and the tool is then drawn at 1050 degrees F. for from two to five hours. Many users do not bother to draw.

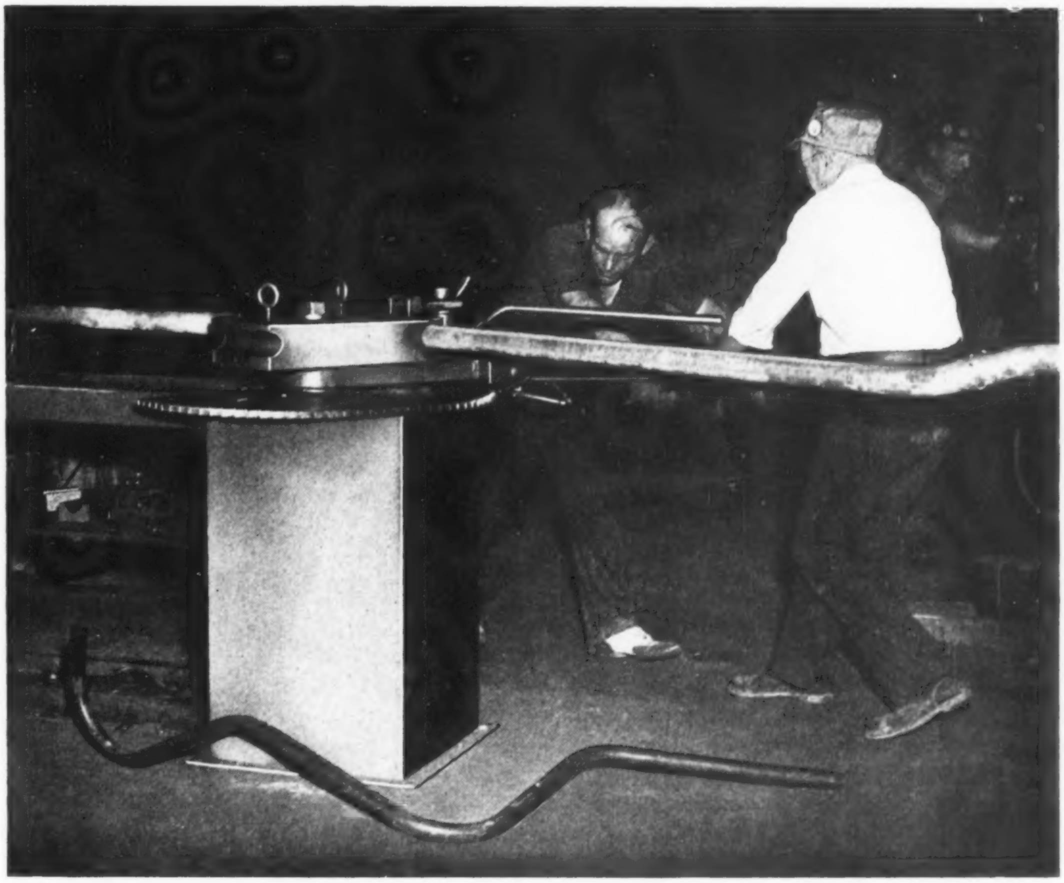
In fact, most of the concerns using this type of jig for the bonding of carbon tool-steel and high-speed steel inserts have not attempted to heat-treat the inserted bit after the brazing operation. In spite of this, they have secured excellent results in subsequent cutting operations. They prefer the silver-soldered joint with heat-dissipator shoe to that utilizing a welding compound. By using a thin shim of silver solder, inclusions of air and flux are held to a minimum, heat conduction is excellent, and a good bond is obtained over a maximum contact area.

Pipe-Bending Operation in a Shipyard

Pipe-bending machines of several types are found in the yard of the South Portland Shipbuilding Corporation, Portland, Me. A Wallace pipe-bender employed on pipe up to 2 inches in diameter is shown in the illustration. It will be seen that the pipe is clamped to a form at the front of the machine, which is revolved on a base by the manual operation of a ratchet mechanism. The opposite side of the pipe is held against an adjustable roller, which serves as an anvil. The portion of the pipe being bent, as well as the section in front, swings around with the form during the bending operation.

* * *

According to the Office of War Information of the War Production Board, the output of machine tools in October (the last month for which complete statistics are available) reached a new high level of about $130,000,000, which represents an increase of 8.3 per cent over the output in September. This is at an annual rate of $1,560,000,000, or nearly twice the rate at this time last year.



Typical Pipe-bending Operation on a Machine that has a Capacity for Bending Pipe up to 2 Inches in Diameter

Checking the Teeth of Gears for Electric Locomotives

Gears with ground teeth are essential to modern high-speed electric locomotives, because when one of these locomotives is traveling at high speed, the gears are running at approximately 6000 feet a minute around their pitch circles, while the pinions operate at about 1900 R.P.M. Obviously, to obtain quietness of operation at such high pitch-line speeds, the contour of the gear teeth must be as near a true involute curve as it is possible to produce. The illustration shows an inspector in the Nuttall plant of the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., checking the contour and symmetry of electric-locomotive gear teeth by applying an instrument that checks the contour within limits of 0.00005 inch. The same inspector also applies a special instrument for checking the tooth spacing. The grinding method by which the required tooth accuracy is obtained was described in April, 1942, MACHINERY, page 149.

Applying a Special Instrument which Checks the Contour of Gear Teeth to within 0.00005 Inch

Six Points on the Conservation of Electrodes

In a talk before the Cleveland section of the American Welding Society, H. O. Westendarp, welding engineer of the General Electric Co., Schenectady, N. Y., suggested the following six points as a guide in the conservation of electrodes for arc welding:

1. Select the largest diameter and greatest length electrode that can be applied successfully. This not only speeds up deposition rates of weld metal, but also results in a decided increase in the tonnage of electrode that can be extruded daily with existing facilities.

2. Joints to be welded must have good "fit up"—excessive gaps waste metal.

3. Use proper amperage for the job—avoid excessive currents and long arcs. There is a current beyond which the deposition rate is decreased and electrode consumption increased.

4. Do not bend electrodes unless absolutely necessary. Bent electrodes destroy the electrode coating and result in excessive stub losses.

5. Produce true fillet welds having equal legs—to this end, use the proper type of electrode and welding technique.

6. Use each electrode down to a point where the full coating ends.

* * *

Hardening Sterling Silver

Sterling silver, which contains 925 parts of fine silver to 75 parts of copper by weight, can be hardened by heat-treatment. It can also be hardened by cold-working. Sterling silver can be as soft as 12 scleroscope (universal hammer) or 18 Rockwell (1/16-inch ball — 100-kilogram load). This softness is obtained by heating the silver to 1400 degrees F. and instantly quenching it in water. On the other hand, sterling silver that is heated to 700 degrees F. and quenched, has a scleroscope hardness of 23 and a Rockwell hardness of 47. The principal uses for hardened silver are in the industrial field, where silver is now used for electrical contacts. Obviously, the hardness tends to promote resistance to wear of the silver.

Building Liberty-Ship Steam Engines

Fig. 1. The Six Columns for Each Marine Steam Engine are Mounted together on a Planer Table for Simultaneously Finishing the Top and Bottom Ends

LIBERTY ships are driven by marine steam engines of vertical triple-expansion type. Many of the operations performed at the Hooven, Owens, Rentschler Division of the General Machinery Corporation, Hamilton, Ohio, in building these engines at an average of twenty a month were described in November, 1942, MACHINERY. Additional operations will be described in the present article.

There are three front columns and three back columns on these marine steam engines. The lower ends of the columns are bolted to the bed and the top ends to the feet of the three cylinder castings. All six columns for an engine are planed at one time by setting them up on a planer table in the manner illustrated in Fig. 1. The machine shown in use is a Niles 15-foot planer. Both ends of the column are finished at the same time by using two side-heads, the specified length between the two ends being 13 feet 1 inch. The bottom surfaces of these columns must fit the bedplate so closely that it is impossible to insert a feeler gage between the two engine members. The same is true of the relation between the top of the columns and the corresponding cylinder feet.

An astern eccentric rod is finish-turned along the arm by the engine lathe shown in Fig. 2, which is equipped with a holding device on the tailstock end that compensates for the offset between the center of the eccentric rod at the strap end and the center at the yoke end. With this arrangement, the arm section of the eccentric rod revolves in a truly cylindrical path. The contour of the arm where it joins the strap end is also turned in this operation, the tool being fed outward automatically by means of the taper attachment at the rear of the bed to provide the required contour.

A large number of holes are drilled and tapped around the cylinders by means of radial drilling machines. Fig. 3 shows an operation of this type being performed by a Niles radial drilling machine on a high-pressure cylinder casting. Jig plates insure the drilling of holes accurately as to location. Fourteen holes are drilled and

Fig. 2. (Above) Turning the Arm of an Eccentric Rod by the Use of a Set-over Device that Produces Concentric Rotation

Fig. 3. (Below) Set-up for Drilling and Tapping a Large Number of Holes in a High-pressure Cylinder Casting on a Radial Drill

Fig. 4. Assembly Platform on which the Valve Link-bars and Valve Link-blocks are Attached to the Eccentric Rods after the Bearings have been Line-reamed

tapped around a circle to receive 1 1/4-inch valve-chest cover studs. Then twenty-four holes are drilled and tapped around a larger circle for 1 1/2-inch cylinder head studs, and nine holes are drilled and tapped along one end of the casting for 1 1/4-inch intermediate valve-chest cover studs. All these holes are produced in one set-up of the work.

Fig. 4 shows the means employed to obtain proper fitting of valve link-bars and valve link-blocks to the yoke end of eccentric rods. A double reamer, such as seen in the bearings of the third eccentric rod from the left, is employed to finish the two bearings in close alignment. The operation is conveniently performed by bolting the lower end of the eccentric rods to plates in a pit, so that the rods extend upward in the same manner as when they are installed on an engine. The double reamer used in this operation is hand-driven.

Reclamation of Tool Steel Grindings

The salvaging of critical materials is becoming increasingly important as war production increases. Materials normally discarded as non-reclaimable waste are now finding an important place in industry's salvage program. An example is that of high-speed steel grindings. According to the Automotive Council for War Production, in one plant where an effort was recently made to salvage this material, 6085 pounds of high-speed steel grindings were collected in a month's time and made available for reprocessing so that other high-speed steel tools could be made.

Plastic Oil-Shields on Screw Machines

The plastic material "Lumarith" made by the Celanese Celluloid Corporation, 180 Madison Ave., New York City, has been successfully applied for shields on automatic screw machines, turret lathes, and similar equipment. The chief advantages of these shields, compared with metal shields, is that they are transparent, very clear, and easy to keep clean. Lumarith shields permit the operator to observe the working parts of his machine the same as if there were no guard. Light weight, flexibility, and simplicity of installation are other advantages.

Engineering News Flashes

Diesel Crankshaft Wears 0.001 Inch in a Million Miles of Service

Recently the Diesel engines of one of the world's fastest streamline trains on the Union Pacific Railroad were checked over after the engines had run a million miles in service. The wear on the crankpins was found to be only 0.001 inch, although the train had traveled a distance equivalent to forty times around the world. The crankshafts of these Diesel engines were hardened by the Tocco process, introduced by the Ohio Crankshaft Co., Cleveland, Ohio. It is stated that this electrical induction hardening method is mainly responsible for the very slight wear of the crankpins after such long service.

Giant Electric Transformers Just Completed

Two electric transformers, each as big as a six-room house and the largest ever built at the Sharon plant of the Westinghouse Electric & Mfg. Co., have just been completed. These transformers weigh 257 tons each. They are intended to handle power for a new aluminum plant, and will step up electric power from 27,000 to 132,000 volts. The construction of the two transformers required about 188 tons of structural steel, 111 tons of special core steel, and 130 miles of copper wire, weighing 29 tons. The transformer tanks hold 44,000 gallons of oil, enough to fill eight average railroad tank cars. Each transformer is 25 feet high, 39 feet long, and 24 feet wide.

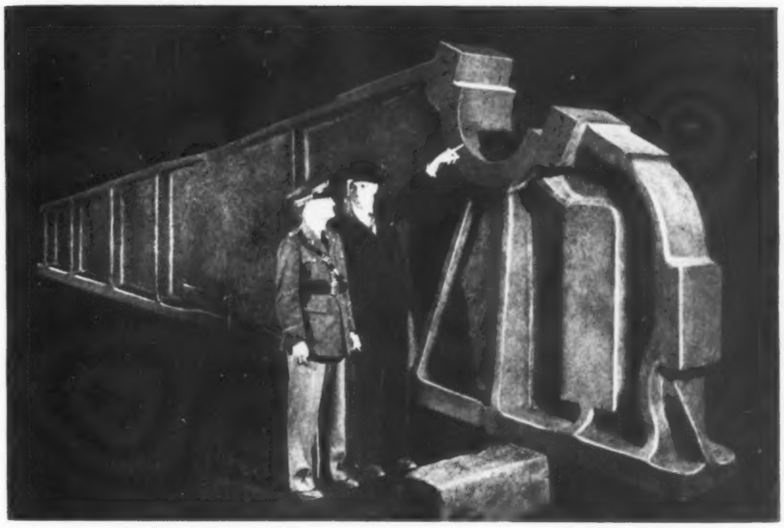
Saving Electric Current by the Use of Capacitors

In the metal-working plant of R. D. Cole Mfg. Co. at Newnan, Ga., General Electric Pyranol capacitors are being used to save power and improve voltage regulation of group and individual alternating-current motors. The capacitors are installed on large motor terminals and at load centers on the power feeders in the plant. The capacitors at the load centers are connected to enclosed fusible knife switches, while those on the large motor terminals are in operation only when the motors are running.

Before the installation, the power factor of the plant was approximately 50 per cent, due largely to a variation in the load caused by electric welding operations and to magnetizing current far in excess of the working current. The capacitors are adjusted to keep the power factor above 90 per cent. Their installation has brought about a definite improvement in the efficiency of the electric system and a substantial reduction in the company's power bills.

The Expression "Better Material-handling Facilities" does Not Apply to Cranes, Hoists, and Shop Trucks Alone. It also Applies in the Instance Shown in the Accompanying Illustration, where All the Parts to be Assembled are Placed within Easy Reach of the Operator. This Fan-shaped Arrangement is Used in the Assembly of the De-Ion Line Starters at the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co. More than 1000 Parts and 75 Different Materials are Used in the Assembly of These Line Starters; Hence the Importance of Simplified Materials Handling for the Girls who Assemble the Device

One of the Huge Castings Required for a 16-inch Coast Defense Gun which, when Mounted, has a Weight of 700,000 Pounds. Someone has Figured out that there is Enough Steel in Such a Gun to Produce 350 Automobiles, 4600 Washing Machines, or 3100 Refrigerators



Giant Navy Cranes Reach the Roof of a Twelve-Story Building

The Wellman Engineering Co. and the R. W. Kaltenbach Corporation are constructing nine huge cranes, the booms of which will reach above a twelve-story building. The cranes are built for the United States Navy Bureau of Yards and Docks. They are of what is known as the drydock type, and will run on four rails. They will be completely self-contained and self-powered. One man in a glass-enclosed control room directs all movements. The cranes are provided with Cooper-Bessemer Diesel engines, thus making each crane an independent power unit and eliminating the need for conductors along the tracks. This assures that the cranes will be able to operate in emergencies when there may be a breakdown of the electric power.

New Transformer Cooling System Saves Scarce Materials

Vitally needed increases in power transformer capacities can now be obtained quickly with a new system of forced-oil cooling that is said to save 25 per cent in war materials on new transformers. The new cooling unit, called the "Electro-Cooler," which was developed by the Allis-Chalmers Mfg. Co. as a wartime measure to save copper and steel, will step up the capacity of transformers already in service by about 20 to 60 per cent.

The "Electro-Cooler" consists of a radiator type cooler and a special pump with motor enclosed. These are connected by piping to the standard radiator valves at the side of the transformer. No stuffing-boxes are required in the special pump, and the motor is self-cooled and self-lubricated. Because the new cooling unit is relatively small, usually more than one is required, the number depending on the size of the transformer. Greater reliability can be expected from the multiple units, since operation of one is not dependent upon the other. As the application of the "Electro-Cooler" avoids the necessity of adding new transformer units, it is a much needed solution to the wartime problem of overloaded transformer banks.

Metal Lead Primer Replaces Aluminum Paint

One substitute for aluminum priming paint, the sale or manufacture of which has been prohibited by government order, is a paint prepared several years ago to protect outdoor displays and large Neon signs. This paint, known as Hyspar metal lead primer, is manufactured by the Midland Paint & Varnish Co., Cleveland, Ohio. Because of its metallic non-rusting components, it is said to provide protection equal to that of a good aluminum paint. It can be brushed, dipped, or sprayed on, and dries in four to five hours.

Largest Pipe Line Has Just been Completed

What is known to oil men as the "Big Inch" pipe line, because of its 24-inch diameter, has just been completed. This oil-pipe line extends from Longview, Tex., to Norris City, Ill., a distance of 550 miles. Its 24-inch diameter pipe makes it the largest diameter oil trunk pipe line in the world. Fifteen General Electric 1500-H.P. motors will be used to drive centrifugal pumps in booster stations at intervals along the pipe line. These pumps will keep 1,330,000 barrels of oil flowing at a rate of four miles per hour, or at a delivery rate of 300,000 barrels a day at Norris City. In the construction of the motors, cast iron is used instead of welded steel plate construction to conserve steel.

EDITORIAL COMMENT

American Industry will Again Rise to the Occasion

The task before American industry in the coming year challenges the imagination. We are told that war production alone will run into a value of from eighty to eighty-five billions of dollars. That is about equivalent to the country's highest peacetime production of civilian goods, so that, were it not for industry's ability to increase its productive capacity, there would be no facilities left for civilian needs after the war demand had been filled.

While, obviously, civilian needs will not be filled as completely as they have been in peacetime, nevertheless this nation—in order to continue to function in the carrying on of the war and the war industries—must be fed, clad, and housed in a manner that does not involve extreme hardships. Hence, industry faces the task of producing for war purposes as much as it has ever produced for civilian needs, in addition to all that is needed for reasonable civilian requirements. That American industry will rise to the occasion no one questions; but it will require that everybody—whether engaged in industrial work or not—do his part.

A very serious problem is the lack of materials. Without an adequate supply of scrap iron, our steel mills cannot function. One of the great tasks is to get every available piece of metal scrap collected and transported to locations from which they can be conveniently shipped to the steel mills. In time, synthetic rubber will adequately replace natural rubber; it may even prove superior to the natural material. In the meantime, however, scrap rubber has become of the utmost importance, and conservation of rubber in all its forms is a national duty. The need for intelligent cooperation by all concerned cannot be too strongly emphasized.

Cooperation Brings Successful Results in Sub-Contracting

Many manufacturers have been highly successful in sub-contracting work on war contracts, while others say that sub-contracting frequently results in failure and that the sub-contractor is often unable to fulfill the exacting requirements of war materials manufacture.

It appears that successful sub-contracting depends largely upon the attitude and the methods of the firm holding the prime contract—the firm that engages the sub-contractors. If, in placing sub-contracts, the procedure is followed of merely asking a number of small firms to bid competitively on the work to be performed, it is very likely that the results will prove unsatisfactory. On the other hand, if the methods described in the following, which have been adopted by several successful prime contractors, are adhered to, sub-contracting can prove very satisfactory.

In such cases, the prime contractor sends his own engineers to various small shops that may be able to take sub-contracts. These engineers determine what kind of work the smaller shop is capable of performing; they aid the manager of the small plant in devising ways and means of successfully doing the work, giving him engineering advice and inspection service.

In many cases, the prime contractor even aids the smaller shop in arriving at its cost figures. For example, in one instance a small shop was given half a dozen pieces as an experiment and told: "Finish these according to the drawings and specifications, return them to us for inspection, and tell us how much you could make them for if you had a contract for 10,000 pieces." The small shop completed the six sample pieces; they were made accurately to specifications; and the statement was made that it would cost $1.25 to make them in quantity. This was a satisfactory price and the contract was placed.

The main thing that prime contractors have learned with regard to sub-contracting is that the smaller shop must be aided in many ways. It must be given engineering advice and assistance; it may have to be furnished with tooling equipment; and it must be guided in its inspection methods. With such aid, however, hundreds of small shops throughout the country are today materially helping in the war program.

Buick Manufactures Bomber Engines

Second Installment of an Article Describing Operations in an Airplane-Engine Plant which has Greatly Exceeded Original Production Schedules

By CHARLES O. HERB

WHEN the automotive industry builds and equips a plant for the manufacture of a new product, it is to be expected that the methods adopted will be the very latest. That this is true of the factory recently built by the Buick Motor Division of General Motors Corporation for the production of Pratt & Whitney twin-row radial aircraft engines was indicated in the first installment of this article, which appeared in July, 1942, MACHINERY. The present article will describe additional high-production operations in this plant.

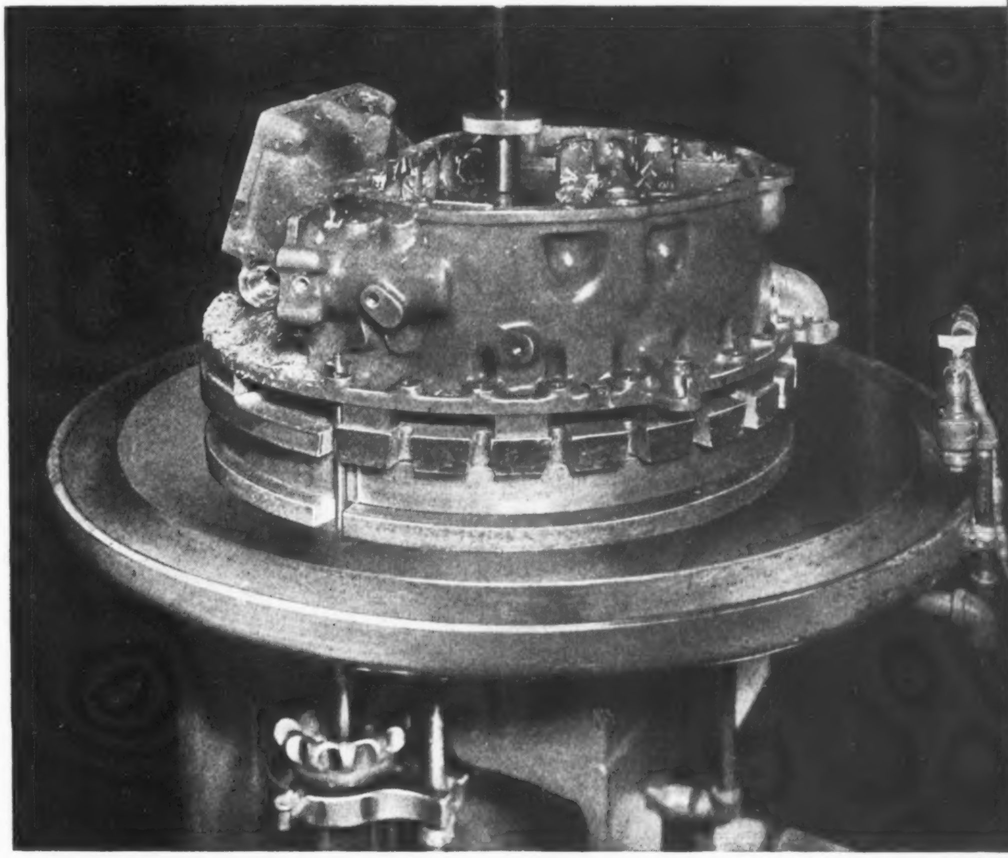
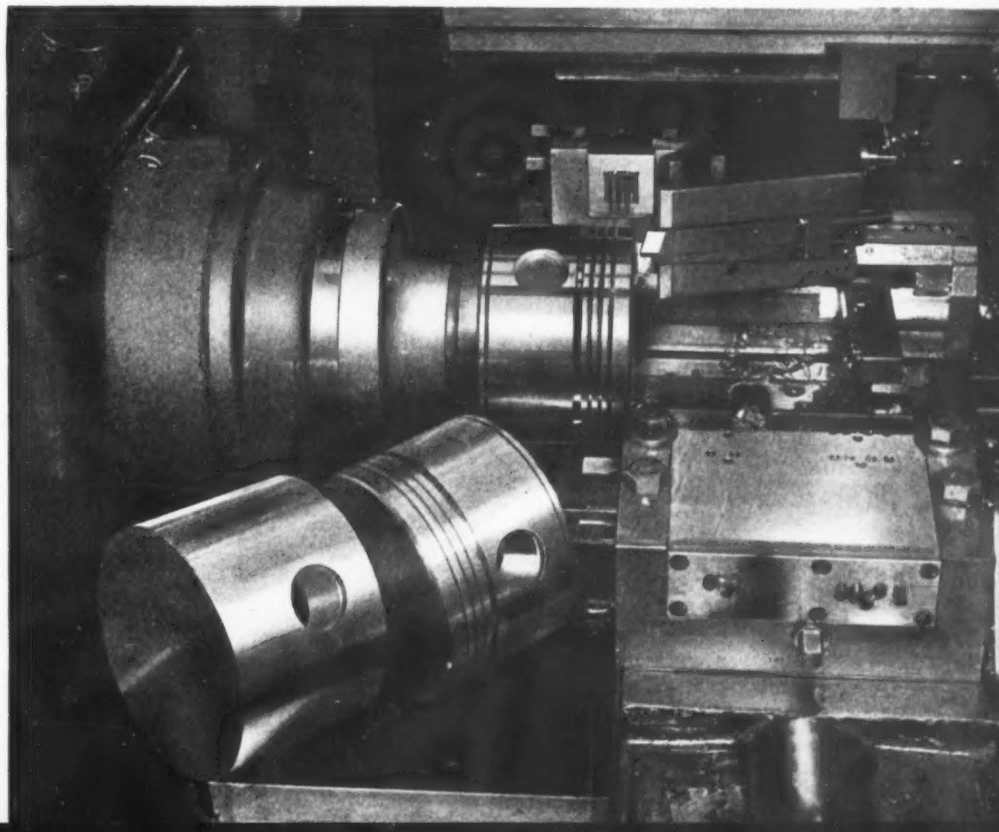


Fig. 13. Some of the Bosses around One of the Blower Castings can be Finished Only by the Use of a Back Spot-facing Tool

In Fig. 13 is shown a Taft-Peirce machine of vertical design being used for back spot-facing a number of holes in the flange of the intermediate blower section, which cannot be spot-faced from overhead because of the integral lugs on the work.

A vertical tool-spindle is raised successively through each hole to be back spot-faced and the spot-facing tool is mounted on the upper end of the spindle. The cut is then taken by feeding the tool downward, after which the cutter is removed to enable the spindle to be withdrawn through the hole. Eighteen holes are back spot-faced in this operation, the machine being provided with an indexing fixture, so that each of the holes can be readily brought in position

Fig. 14. Tooling Equipment Provided on an Automatic Lathe for Finish-turning, Grooving, Facing, and Chamfering Pistons



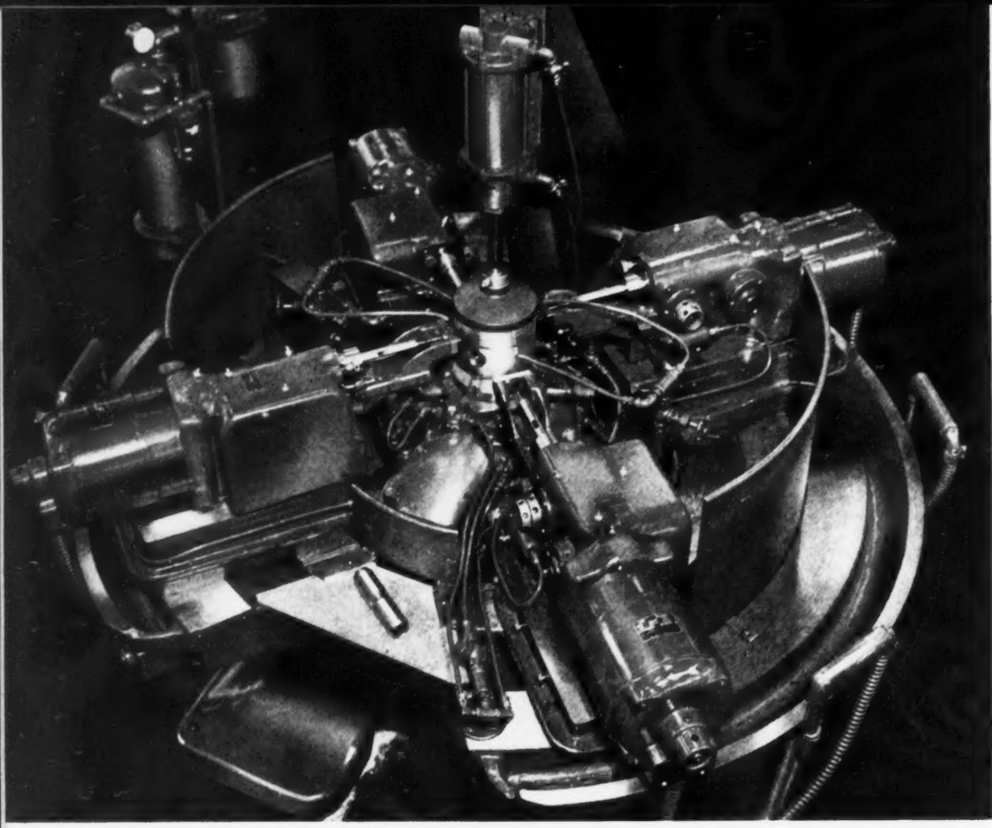


Fig. 15. Special Four-head Drilling Machine that Automatically Produces All of the Oil-holes around the Piston Grooves

above the cutter-spindle. The thickness of the flange between the faced surfaces and the finished under side of the flange must be held to size within plus or minus 0.010 inch.

The pistons are finish-turned and grooved on Sundstrand automatic lathes, tooled up as illustrated in Fig. 14. At the beginning of this operation, a cutter on the front slide is fed longitudinally to finish-turn the piston for its complete length, and at the same time, a cutter on the rear slide is advanced for facing the closed end of the piston. Then, as the front slide is fed crosswise, five cutters on this slide start rough-turning the four ring grooves near the closed end of the piston and the wiper-ring groove near the skirt end. Another cutter on this slide chamfers the closed end. Finally, the rear slide is advanced to bring forward four cutters that are ground to the correct form for turning the four ring grooves to the desired width, with a side taper of 8 degrees included angle. The facing tool on the rear slide is relieved by a cam bar when it is returned to the rear of the machine, so as to avoid scoring the closed piston end. All the cutters used on this automatic lathe are tungsten-carbide tipped.

Special four-head Kingsbury machines, constructed as shown in Fig. 15, drill all the oil-holes in one of the piston-ring grooves and in the wiper-ring groove of the pistons. Fourteen holes are drilled in the wiper-ring groove, the holes being arranged in groups of seven on opposite sides of the piston. Ten holes are drilled around the piston-ring groove.

In an operation, the piston is seated on a plug in the center of the fixture which engages the skirt end. Then a locating plug, such as seen lying at the front of the machine, is inserted through the wrist-pin bores and into engagement with fingers in the center of the fixture, which grip the neck in the middle of the locating plug. The piston is now securely clamped by means of an overhead Logan air cylinder.

The spindles on two of the heads on opposite

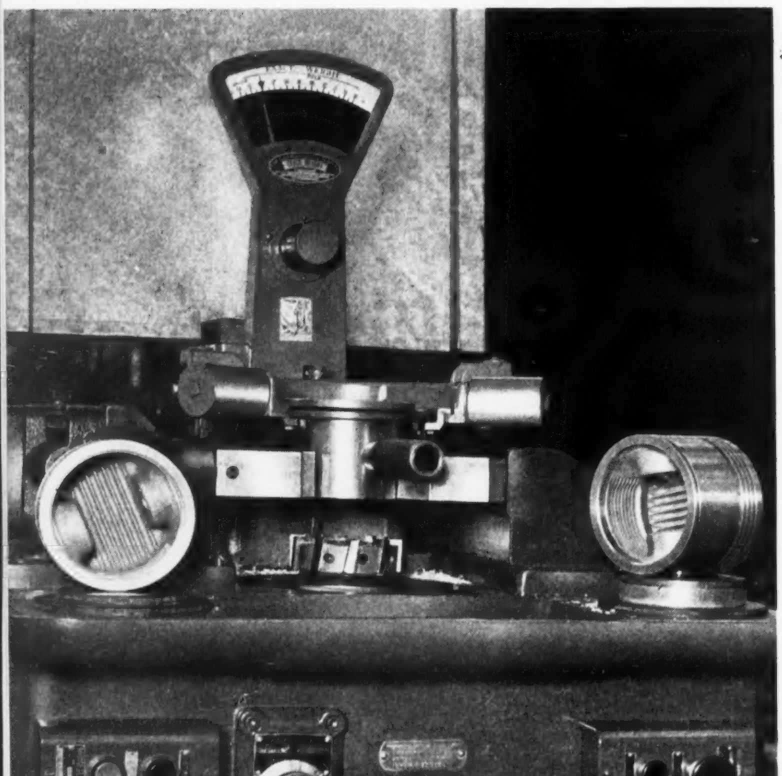


Fig. 16. Machine that Automatically Checks the Weight of Pistons and Makes Correction for Over-weight

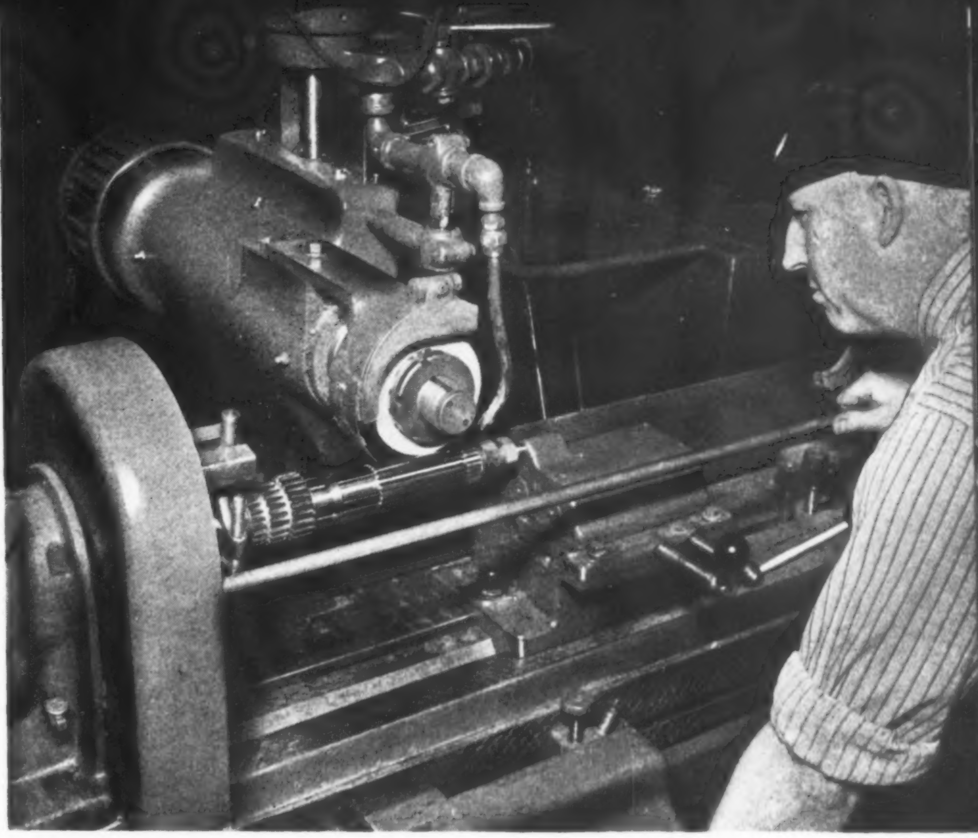


Fig. 17. Spline Grinding Operation on a Part Having a Number of Internal and External Surfaces that Must be Closely Concentric

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sides of the machine are operated back and forth in one plane for drilling the holes in the oil-wiper groove, while the spindles on the other two heads are located at a higher level for drilling the upper groove. The holes drilled by the upper and lower heads are not parallel, neither are they drilled to the same center distances. Therefore, the four heads cannot be operated in unison, the bottom heads being operated as a pair and the upper heads as a pair between indexings of the work.

When the pistons have been completely machined, they must weigh the specified amount within 0.12 pound. They are automatically checked for weight and corrected for overweight on the Snyder machine illustrated in Fig. 16. For this inspection, each piston is slipped into a sleeve type of adapter having a handle that is inserted into one of the wrist-pin bores. This adapter is placed between a movable and a stationary vise jaw on the scale beam. The beam will assume a certain position, depending on the piston weight, after which the piston is clamped through the operation of a Logan air cylinder on the left-hand side of the machine. The air cylinder actuates a slide which tightens the movable scale beam jaw against the adapter.

Then the machine is started to feed an inserted-blade end milling cutter upward for counterboring the skirt end of the piston. The depth of this cut depends upon the position taken by the piston due to its weight. In other words, the milling cutter always rises to the same height, but the position of the pistons varies according to their weight. The milling cutter is 4 23/32 inches in diameter. The weighing unit of this equipment was supplied by the Exact Weight Scale Co.

The gearmaking section of this plant is extensive, as required to produce the large number of gears needed in the building of aircraft engines. All the gear-cutting machines are of conventional types, as are also the gear-tooth grinding machines. In Fig. 17 is shown a

Fig. 18. Milling Clearance on Inside of Lugs on a Crankcase Section with a Cutter Ground to the Required Contour

Fig. 19. Duplex Machine that Drills, Reams, Countersinks, and Chamfers All Holes around Crankcase Cylinder Pads

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Fitchburg spline grinding machine being employed for finishing the splines on an impeller shaft. These splines, as well as the three integral gears, two external bearing surfaces, and two internal bearing surfaces, must all be concentric within 0.002 inch, as determined by full indicator readings.

A milling operation on the rear crankcase section is illustrated in Fig. 18. Here a Van Norman milling machine is being used for milling clearance on the inside of the lugs on the crankcase section. A two-edge form cutter ground to the proper contour is employed for this operation, the table being adjusted longitudinally and crosswise, and the cutter-slide in and out, to position the cutter and work correctly for milling the different lugs.

Each cylinder pad on the crankcase sections is bored, faced, and chamfered at one time on Hall Planamilling machines equipped as seen in Fig. 20. This operation, as will be observed, is performed with the three crankcase sections temporarily assembled together. The lower "deck" of cylinder pads is finished on one machine, and the upper "deck" on another machine on which the distance from the top of the work-table to the center of the cylinder pads is higher. The table indexes automatically to bring the different cylinder pads into line with the cutters. Upon the completion of an indexing movement, the cutter-spindle advances into the work and then moves, in the conventional planetary manner, around the cylinder pad surfaces.

The boring cutter removes approximately 1/4 inch of stock on a side from these aluminum alloy castings, and the finished holes must be to size within a total tolerance of 0.006 inch. The faces of the cylinder pads must be the specified distance from the center of the crankcase within 0.0015 inch, as determined by gages while the crankcase is still on the machine.

The stud-holes in the cylinder pads are drilled, reamed, countersunk, and chamfered by Ex-Cell-O duplex machines of the design illustrated

Fig. 20. Boring, Chamfering, and Facing the Cylinder-pad Holes of Crankcases on a Planamilling Machine

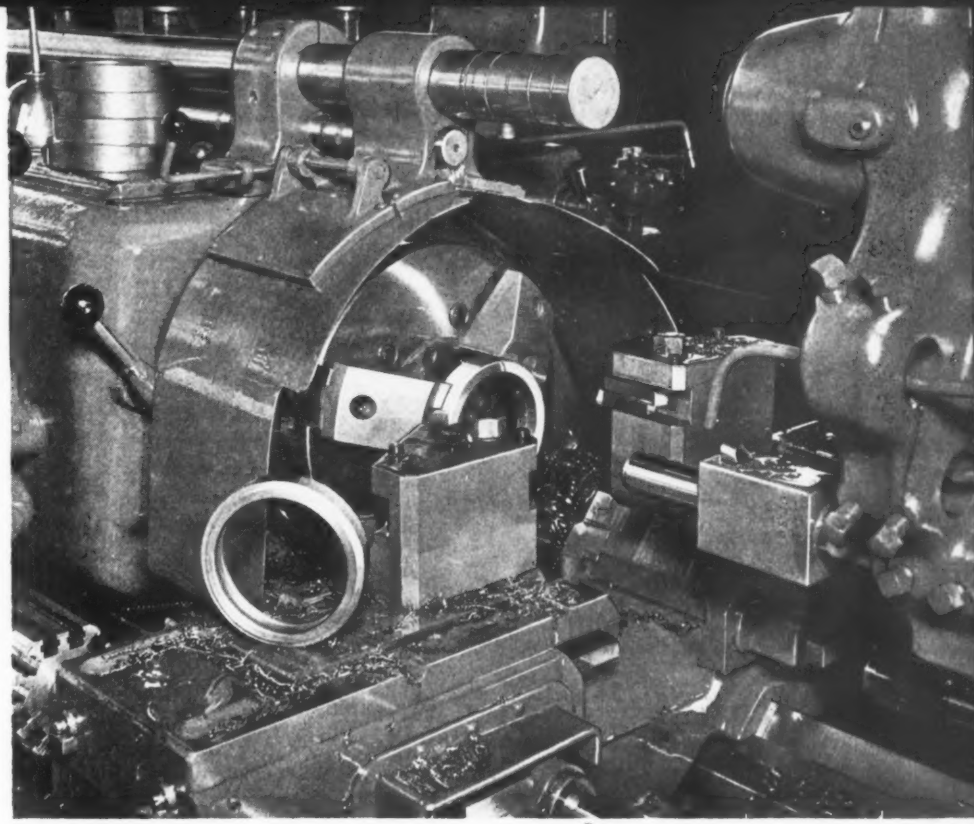

Fig. 21. Turret Lathe Set up for the Fast Production of Oil-seal Collars having a Spherical Internal Groove

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in Fig. 19. Each of the drill heads is provided with sixteen spindles, the head on the left drilling this number of holes simultaneously in one pad within 0.001 inch of specified center distances. At the same time, the head on the right reams, countersinks, and chamfers holes that have previously been drilled by the left-hand head.

At the beginning of an operation, only the left-hand head moves back and forth until a cylinder pad with drilled holes has been indexed into line with the right-hand head, after which the two heads operate in unison until all the pads in one "deck" have been drilled. Then only the right-hand head operates until all the holes have been reamed, countersunk, and chamfered. The drill heads are guided by sturdy bars at the front and back of the machine.

One of a considerable number of turret lathe operations is shown in Fig. 21. It consists of producing hollow steel collars on a Foster Fastermatic. There are two tools on the cross-slide, one at the front for turning the part to form a shoulder, and one at the rear for facing the piece.

A tool on one face of the turret is used to rough-bore the collar, after which a tool in the next turret station cuts a chamfer, this tool being fed radially outward after having been advanced into the work. The next turret station is equipped with a form cutter, which is fed downward on a slide after it has been advanced into the work for cutting a spherical groove on the inside of the part to receive balls. Finally, three tools on another turret face finish-bore, chamfer, and finish-turn the piece.

The War Changes Many Engineering Conceptions

An interesting effect of the war effort has been to make what, in ordinary times, would be considered bad engineering practice desirable from the over-all war production point of view. For example, cars for handling ore at mines are now built from wood instead of from steel. The wooden cars are not so good, but by saving the steel, war production is speeded up. In many instances, old and inefficient machine tools have been pressed into production. They are not efficient, and under normal conditions it would be bad engineering practice to make use of them; but under war conditions, since all other available machine tools are used, they simply add their quota to the total volume of production.

Maritime Commission Awards "M" Merit Pennant

The U. S. Maritime Commission awards its "M" Merit Pennant for outstanding achievements to shipyards and plants that have achieved unusual records in work connected with the building of the Victory Fleet. Recently, the Whitin Machine Works, Whitinsville, Mass., received this recognition. For more than a hundred years, this firm has built textile machinery. It has now been converted to war production, making pump engines and other equipment for the Maritime Commission.

The Homestead Valve Mfg. Co., Inc., Coraopolis, Pa., celebrated its fiftieth anniversary this fall by receiving the "M" Merit Pennant from the Maritime Commission.

Unusual Grinding Making War

GRINDING is playing an increasingly important part in the manufacture of a great variety of products and equipment required by our war program. It provides the most economical means of securing the high degree of accuracy and the unusual finish required in the manufacture of many important units. In some instances, grinding is the only practical means of shaping important parts, due to their hardness or toughness. The grinding operations here described and illustrated give some idea of the wide range of war production work performed on grinders built by the Landis Tool Co.

The Landis crankshaft-web contour grinder shown in Fig. 1 is rather an unusual type of machine, which might be described as a cross between a crankpin grinder and a cam contour grinder. The bed, bed controls, and wheel-base are essentially crank-grinder mechanisms and parts. On the other hand, the work-heads and work-table are simply over-size editions of similar mechanisms employed on the Landis integral cam grinder. Machines of this type are used only for grinding certain in-line airplane-engine crankshafts, but they are being considered for use in grinding crankshafts for radial type engines.

The 10- by 18-inch Type DC plain grinder shown in Fig. 2 is equipped for still another unusual crankshaft grinding operation. In this case, a double-throw radial shaft is squared on the cheeks by feeding the grinding wheel laterally, without the usual rotation of the work. The wheel-base is set at an angle of 4 degrees to the work-table, the wheel being trued with a right-angle truing fixture for grinding the cheeks of the crankshaft square, or at right angles to the axis of the crankshaft bearings.

The grinding of an airplane-engine tappet guide on a Landis 10- by 18-

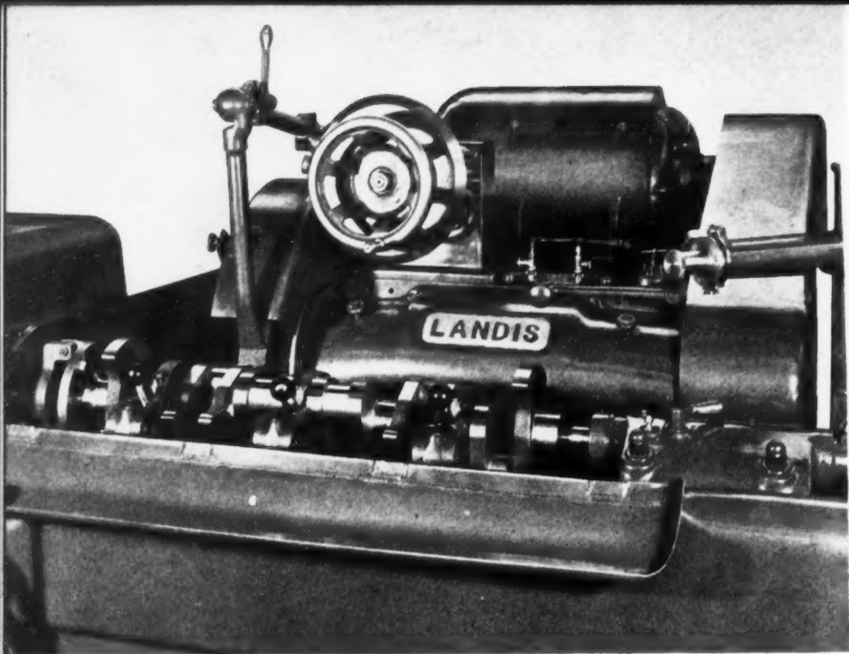


Fig. 1. Landis Crankshaft-web Contour Grinder

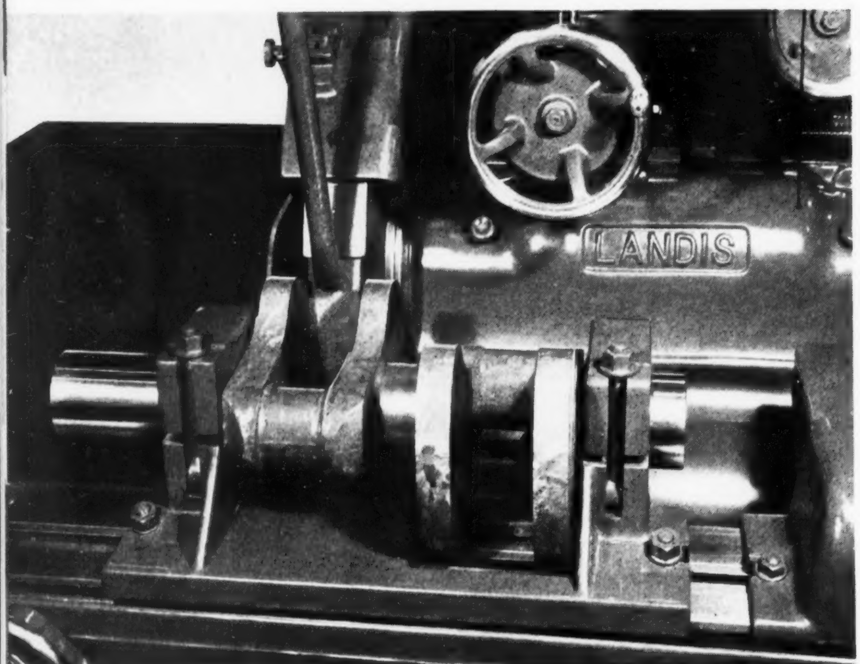


Fig. 2. Grinding Cheeks of Double-throw Radial Engine Crankshaft

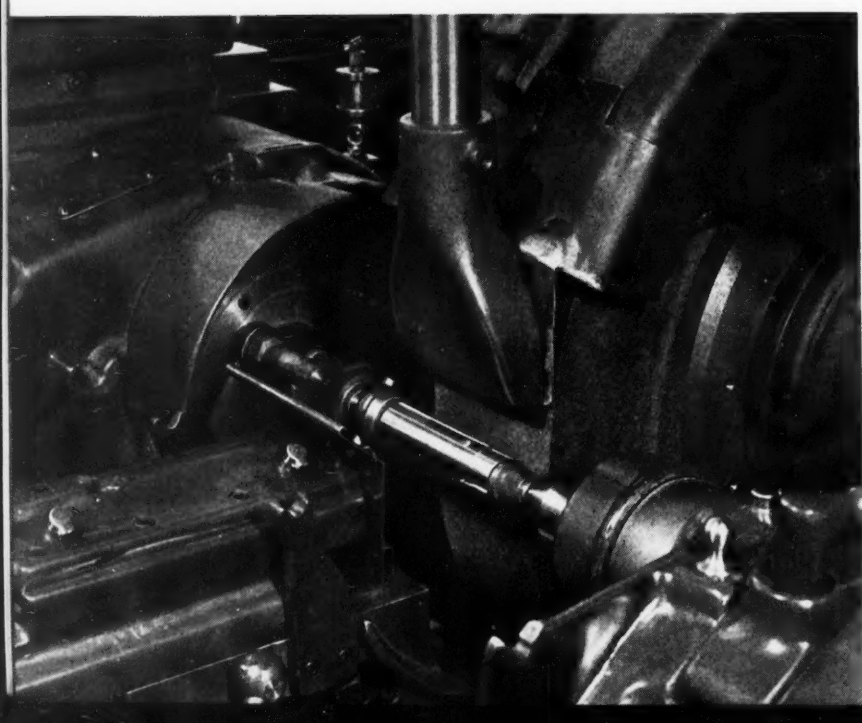


Fig. 3. Grinding an Airplane-engine Tappet Guide

Operations in Equipment

inch Type C plain hydraulic grinder equipped as shown in Fig. 3 is an interesting example of form grinding. In this case, the piece is ground to two different diameters simultaneously, as shown. A wide wheel with the face dressed to the required profile is fed straight in to grind the two diameters to size. The machine used for this work is of conventional type, except that it has a profiling wheel-dresser.

The special fixture shown in Figs. 4 and 5 is employed on a 10- by 18-inch Type C Landis plain grinder for grinding two different radii at each end of a flat gun part. The same machine and fixture are used for both operations without removing the work from the machine or the fixture between operations. A special type of headstock oscillates the work rapidly within a small arc, thereby speeding up the operations and materially improving the quality of the finished work. After grinding one radius, the fixture is simply indexed into position for grinding the other.

The grinding of a cam-shaped surface on a breech-bolt is performed on a Type C plain grinder equipped with a special cam grinding attachment, as shown in Fig. 6. Numerous other small cams and cam-shaped parts can be ground by the use of the same attachment. In some cases, the parts are supported by a footstock, as in the case of the breech-bolt, whereas in other instances, they are merely chucked in the headstock.

* * *

The American Gear Manufacturers Association reports that industrial gear sales for November, 1942, were 49 per cent above November, 1941, and 36 1/2 per cent above October, 1942. The eleven months ending November, 1942, are 32.6 per cent above the corresponding period of 1941.

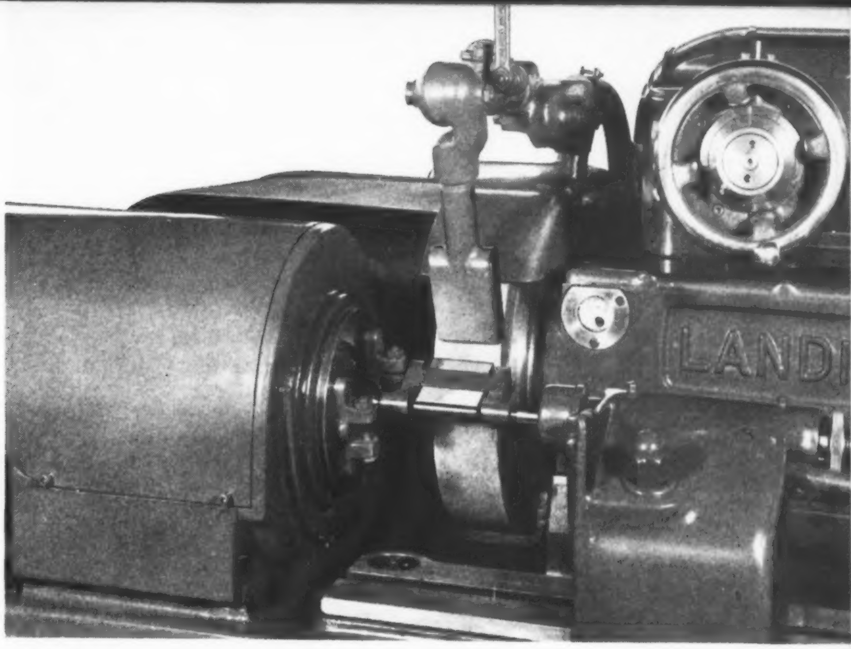


Fig. 4. Grinding Two Different Radii on a Gun Part

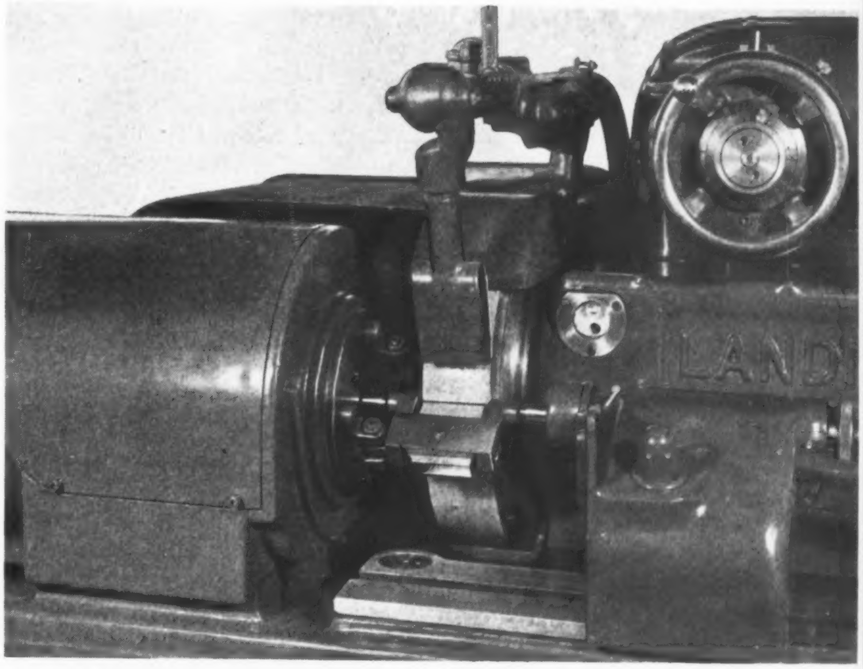


Fig. 5. Work and Fixture Shown in Fig. 4 Indexed for Grinding Second Radii

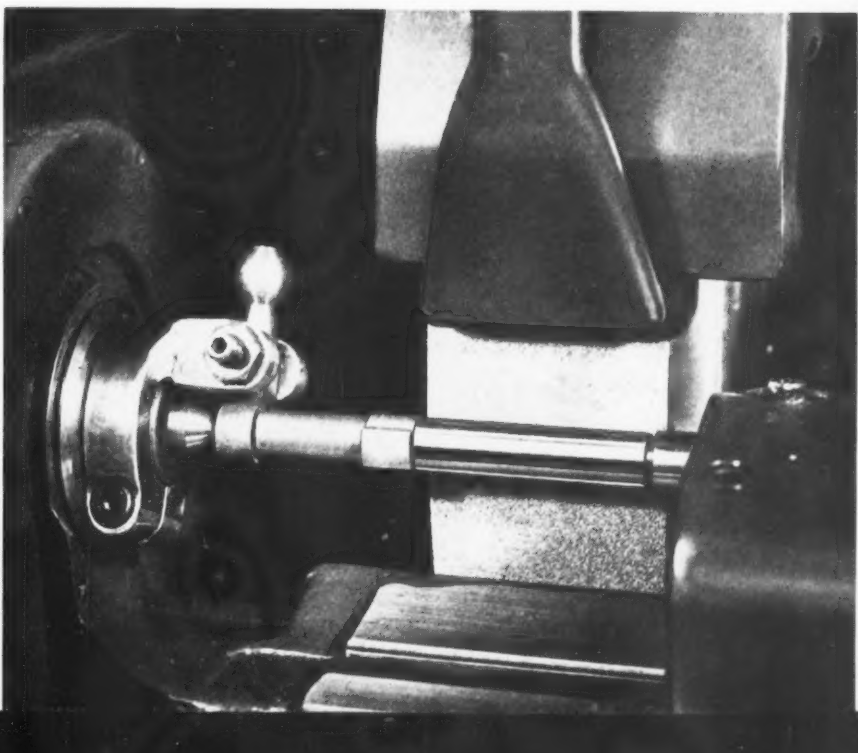


Fig. 6. Set-up for Grinding Cam on Breech-bolt

Reducing Shut-Down Time for Overheated Motors

New Circuit Arrangement Cuts down Cooling-Off Period from One Hour to Four Minutes on Tapping and Drilling Machine Motors

By F. J. JOHNS, Engineer, Motor Division
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

ON tapping and drilling machines that are required to handle up to forty or fifty holes per minute, it is common practice to have a thermal protective device, such as shown in Fig. 1, which will disconnect the motor if it becomes dangerously hot. This may happen, for example, if the operator's ability enables him to exceed the maximum safe rate of operation. With this device for protecting a motor from burning out due to overloads, a bi-metal element operates when its temperature reaches a preset limit, due to heat either from the motor or from a heater carrying the motor current.

Thermal protective devices with heaters that carry the motor current and open the motor circuit are limited to motors of small capacities. In the larger sizes, these safety devices operate in the control circuit of the line contactor or starter, and are heated by the motor itself. Since the operation of the protective device is an indication that the motor temperature has reached the danger point, the usual procedure is to let the motor cool off before continuing the operation. When the temperature returns to a safe level, the thermostat closes and the motor is started again.

From actual experience, it has been found that a cooling period of as long as one hour may be required before the motor is again placed in the circuit. This is due to the high thermal capacity of the motor, to the fact that the closing temperature of the thermostat is lower than the opening temperature, and also to the continued rise in temperature of the motor when it is shut off. Consequently, even infrequent overheating of the motor will reduce production considerably. In some instances, an operator becomes impatient, disconnects the thermal protective device, continues to operate the machine, and finally burns out the motor winding.

The one-hour waiting period has now been

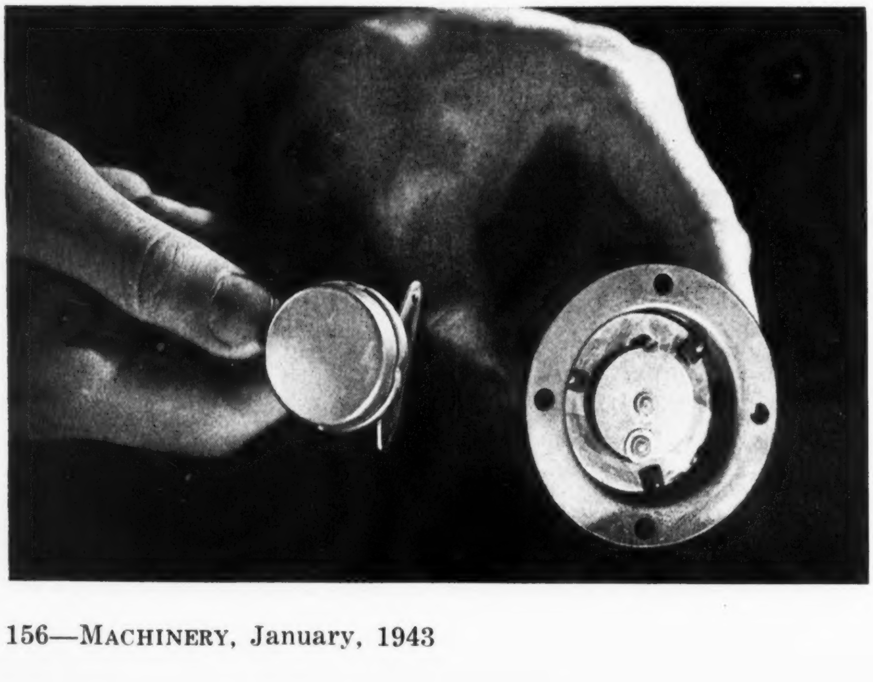


Fig. 1. Two Standard Types of Thermostats without Heaters are Actuated by Heat from the Surrounding Air or Motor to which They are Attached. That at the Left is Installed on the Coil Ends of a Motor Winding, and That at the Right is for Installation on the Motor Core or Laminations. Both Employ a Bi-metal Disk

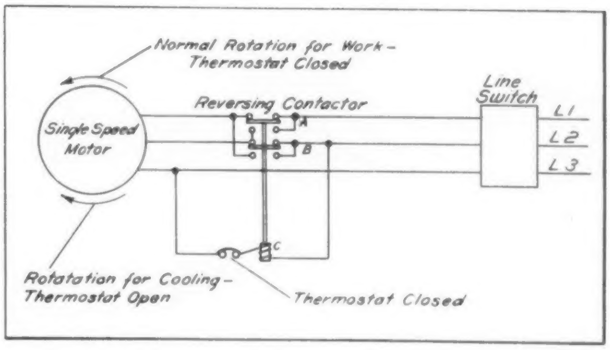


Fig. 2. When the Thermostat Opens, Contactor Coil C is De-energized, Letting Contactors A and B Drop out. Line Leads L-1 and L-2 are Transposed, Reversing the Direction of the Motor. When the Thermostat Cools and Closes, the Motor Automatically Returns to Its Normal Direction of Rotation and Operation of the Driven Machine is Resumed

cut down to four minutes for overheated motors on tapping and drilling machines by using a new circuit arrangement. With this new method, when the thermal protective device is caused to operate by an overheated motor, the control disconnects the motor from the line and then connects it in the reverse direction. With the motor running at top speed in the reverse direction, it is soon cooled by its own built-in fan. Reversal of the direction of the motor makes it impossible for the operator to perform work on the machine, and thus he cannot place any load on the motor before cooling is accomplished. Installation of this control requires no additions to the original line starters or other changes. Extra contactors are necessary, however.

Not only does this new circuit arrangement cut down the non-productive time of these machines, but it also makes it possible on some applications to install a thermal protective device which will operate at a temperature 15 degrees C higher than what previously had been considered safe. This is due to the fact that a motor running without load immediately starts to cool, whereas the temperature of a standing motor will continue to rise as much as 15 degrees C. before starting to decrease. This rise in temperature of the stationary overheated motor takes place because the fan action is stopped and the flow of heat from inside the motor is not carried off as rapidly as when it is in operation. Thus, a period of fifteen minutes after shut-down may be required to reach the maximum temperature rise.

The raising of the allowable safe operating temperature of the motor made possible by the new circuit arrangement means that the drilling or tapping machine can, in effect, be operated at a faster rate. This method for rapid cooling after overheating can also be applied to two-, three-, or four-speed motors which run in one direction or which are reversible.

The diagram Fig. 2 shows one type of connection to a single-speed, three-phase drilling motor in which this new method of control is incorporated. It shows the type of thermostat that is operated by the heat of the motor and controls the contactor coil circuit. This thermostat has no internal heater and does not open the line circuit directly.

Surplus Stocks of Electrical and Mechanical Equipment

The drive inaugurated by the Government to get manufacturers to dispose of their surplus stock of materials includes surplus stocks of all kinds of regularly used electrical and mechanical equipment and accessories, such as electric motors and tools; switches and rheostats; pulleys, shafting, pillow blocks, couplings, and V-belts; gear reducers; fans, pumps, and many other items.

It is of importance that these surplus stocks be disposed of by those who have them available for two reasons: First, because these supplies are urgently needed in the war effort; and, second, because it is possible, if they are not disposed of voluntarily at such prices as now prevail, that the Government may find it necessary later to acquire these surplus stocks at its own price to supply war industry requirements.

Oster Celebrates Fiftieth Year in Business

The year 1943 marks the fiftieth year that the Oster Mfg. Co., Cleveland, Ohio, has been in business. This company manufactures pipe and bolt threading equipment and turret lathes. It was in 1893 that the late Herman W. Oster and Russell B. Tewksbury founded the company. The original quarters—a modest one-story shop—soon grew to a modern well equipped plant, which has expanded again and again to take care of the increased demand for its products. In 1929, the Williams Tool Corporation was merged with it, giving the Oster Mfg. Co. two additional plants, one in Erie, Pa., and the other in Brantford, Ontario, Canada, as well as amplifying the line of equipment being built.

Roger Tewksbury became president and treasurer of the company in 1937, succeeding his father, the late R. B. Tewksbury.

Walter W. Tangeman Becomes President of Machine Tool Builders' Association

As mentioned in December MACHINERY, John S. Chafee, vice-president of the Brown & Sharpe Mfg. Co., Providence, R. I., and president of the National Machine Tool Builders' Association, recently resigned from the latter office in order to accept an appointment as deputy director of the Tools Division of the War Production Board. Walter W. Tangeman, vice-president of the Cincinnati Milling Machine Co., Cincinnati, Ohio, who was first vice-president of the Association, has assumed Mr. Chafee's duties as president of the National Machine Tool Builders' Association. A. G. Bryant, president of the Bryant Machinery & Engineering Co., Chicago, Ill., and J. Y. Scott, president of the Van Norman Machine Tool Co., Springfield, Mass., have been chosen directors of the Association to complete the unexpired terms of George H. Johnson and John S. Chafee who resigned as directors to assume their duties as director and deputy director, respectively, of the Tools Division of the W.P.B.

* * *

High-frequency induction heat used in brazing certain parts for war equipment at a General Electric plant has reduced the time for the operation from four minutes to forty seconds.

Portable Electric Gages Speed Production

The thickness of a metal lining or plating applied to another metal is now being measured directly by a portable electric gage without injury to the lining or plating. Until a few years ago, the thickness of plating had to be checked by the cumbersome process of selecting a few parts at random and cutting them apart so the thickness of the plating could be measured.

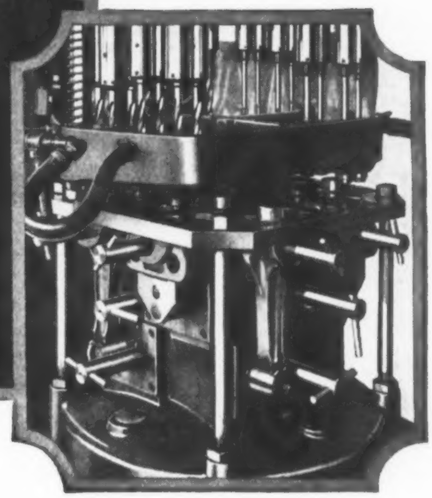
Today, with a seven-pound portable indicating unit having a dial marked off in thousandths of an inch, the thickness of plating or linings is measured without injury to any of the parts being measured. When placed against a surface, the electric gage can measure the thickness of any non-magnetic layer, backed by steel, up to 0.3 inch thick. Originally, this portable electric thickness gage was developed to measure paint coats. The gage can also be used to measure the thickness of sheets of glass or mica if they are placed on steel tables. Another type of gage has been developed for measuring the thickness of non-magnetic metal parts made from aluminum, copper, brass, and bronze.

Production Welding Course to be Given in Cleveland

The urgency for welded ships, guns, and planes has increased the need for a thorough understanding of methods for speeding welding production. To answer this need, an intensive five-day welding production course will be given at the plant of the Lincoln Electric Co., in Cleveland, Ohio, during the week beginning January 11.

This course is organized for foremen, supervisors, production engineers, superintendents, and other executives interested in increased welding production. The course will concentrate on matters that will help those taking it to obtain greater welding production at less cost in their own plants. Lectures, practical demonstrations, and opportunities for testing out new welding methods and procedures will make up most of the intensive five-day schedule. Greatly increased speeds in welding can be obtained by the application of larger electrodes and special positioning jigs and fixtures. The welding production course will bring out these and similar points that will help to speed up the process.

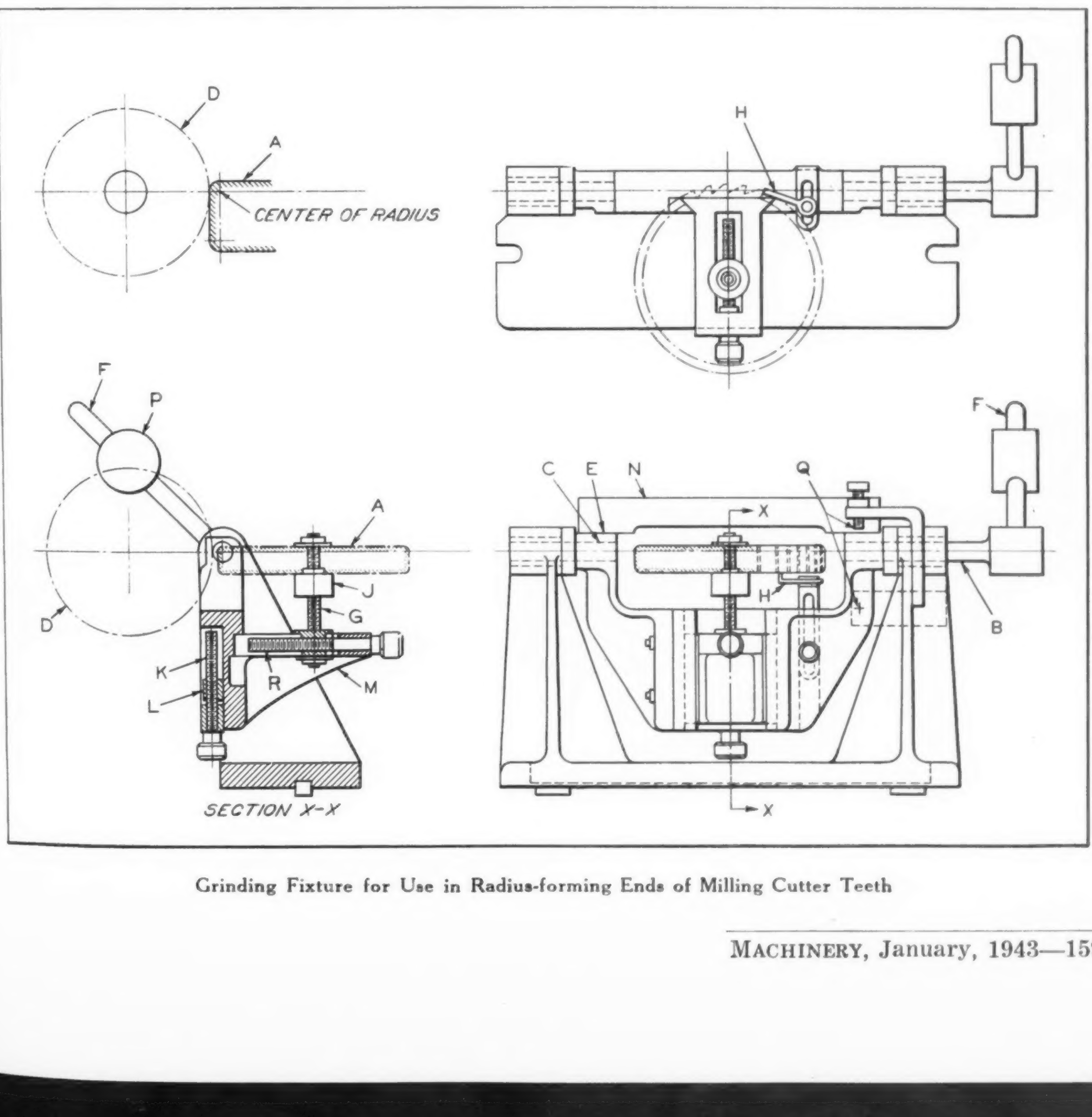
Design of Tools and Fixtures



Radius-Grinding Fixture for Forming Ends of Milling Cutter Teeth

The problem of forming the ends of milling cutter teeth to specified radii has been solved by employing the radius-grinding fixture shown in the accompanying illustration. This fixture is designed to accommodate side and face milling cutters ranging in size from 3 to 10 inches in diameter and of any face width up to 2 1/2 inches.

To grind the end of a tooth to the required



Grinding Fixture for Use in Radius-forming Ends of Milling Cutter Teeth

radius, the cutter, such as the one shown at *A*, is rotated through an angle of 90 degrees about the center from which the radius is laid out. This is accomplished by rotating cutter *A* about the horizontal axis of bar *B* and pin *C*, with the end of the cutter tooth in proper contact with grinding wheel *D*, as indicated in the upper left-hand corner of the illustration.

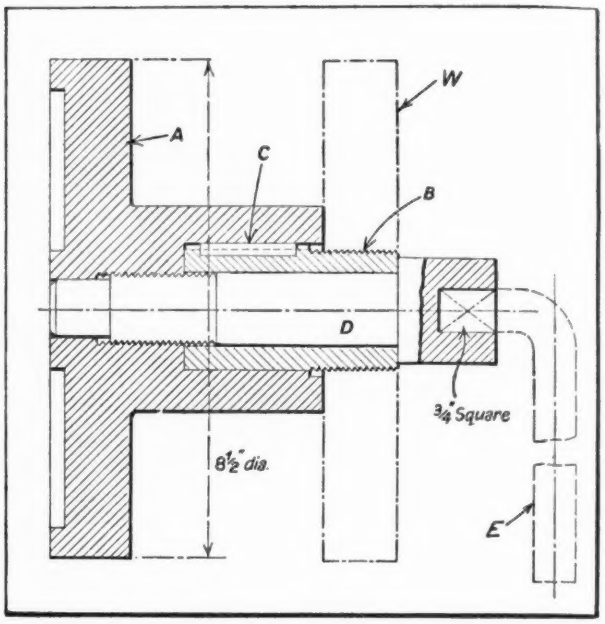
Rotation of plate *E*, in performing this operation, is accomplished by a downward movement of the handle *F*. After grinding the end of one tooth to the required radius, the cutter is indexed to the proper position for grinding the end of the succeeding tooth by revolving the cutter about its own axis on supporting screw *G*. Proper indexing from one tooth to the succeeding one is obtained by means of finger *H*.

Referring to the design of the fixture, the threaded supporting ring *J* can be adjusted on screw *G* to accommodate cutters of different widths. Final vertical adjustment is obtained by means of adjusting screw *K* acting in nut *L*, which is attached to horizontal slide *M*. Supporting screw *G* can be traversed in a horizontal direction by screw *R* to position the cutter properly for the radius-grinding operation.

The two sliding members are attached to plate *E*, which is free to swivel about the center of the radius, being pivoted on bar *B* and pin *C*. The setting or positioning of cutter *A* is accomplished with the aid of a hardened gage *N*, used in conjunction with the machined faces on swivel-plate *E*. The cutter face of the gage is located a predetermined distance from the center of the radius. By subtracting the radius dimension from this distance, the correct dimension is obtained for selecting gage-blocks for positioning the cutter within accurate limits.

The balancing weight *P* counteracts any tendency of the swivel-plate to fall back suddenly against stops *Q*, and also prevents undue fatigue of the operator. To operate the fixture, handle *F* is moved in a downward direction after the slides have been set to the gage and the stops adjusted for the movement of the swivel-plate through the angle of 90 degrees required to form the radius on the cutter. The spring-steel finger *H* is provided to maintain the squareness of the radius with the center line of the cutter. This finger can be adjusted for height in accordance with the cutter width.

When one tooth has been ground, the cutter is rotated about its own axis, forcing the finger out of position until it springs back on the next tooth. The swivel-plate and slide assembly is supported by a cast-iron base, which is positioned on the machine table by tenons. The fixture, as shown, is used for grinding cutters with straight teeth, but cutters with spiral teeth can be ground by providing an interchangeable swivel type horizontal slide. H. G. W.



Chuck Designed to Permit Disk-shaped Work W to be Readily Released from Threaded Arbor

Chuck for Holding Disk-Shaped Work

Difficulty is often experienced in holding disk-shaped work like the piece shown by the dot-and-dash lines at *W* when performing machining operations on the outer edge. Part *W* is 8 1/4 inches in diameter and 1 1/2 inches thick, and has a 2-inch tapped hole in the center. When screwed on a 2-inch threaded chuck, considerable difficulty is experienced in removing it after the machining operation. A chuck made as illustrated has overcome this difficulty.

The main part *A* is of mild steel, but it could be made of cast iron. It is machined to suit the nose of a turret lathe. The sliding sleeve *B*, made of tool steel, is hardened and machined to a close running fit in part *A*. Key *C* allows sleeve *B* to slide without rotating. The mild-steel bolt *D* is made a close running fit in members *A* and *B*.

To operate the device, bolt *D* is first tightened lightly, so that there is no end movement of member *B*, and work *W* is then screwed on member *B* until stopped by the shoulder on *A*. To remove the part, bolt *D* is given a fraction of a turn with a special key *E* inserted in a square hole. This allows sleeve *B* to slide forward, releasing the work *W*. B. M.

Tapping Fixture for Small Part

By ALEX S. ARNOTT, Toronto, Canada

The hand tapping fixture shown in the accompanying illustration was devised recently for use in filling an order for 200 small parts. The

part to be produced has four bosses. One is a blind boss, and the three others are reamed to size and tapped for a 1/2-inch 27 National Standard thread, 5/16 inch deep, as indicated by the two views shown in the upper right-hand corner of the illustration.

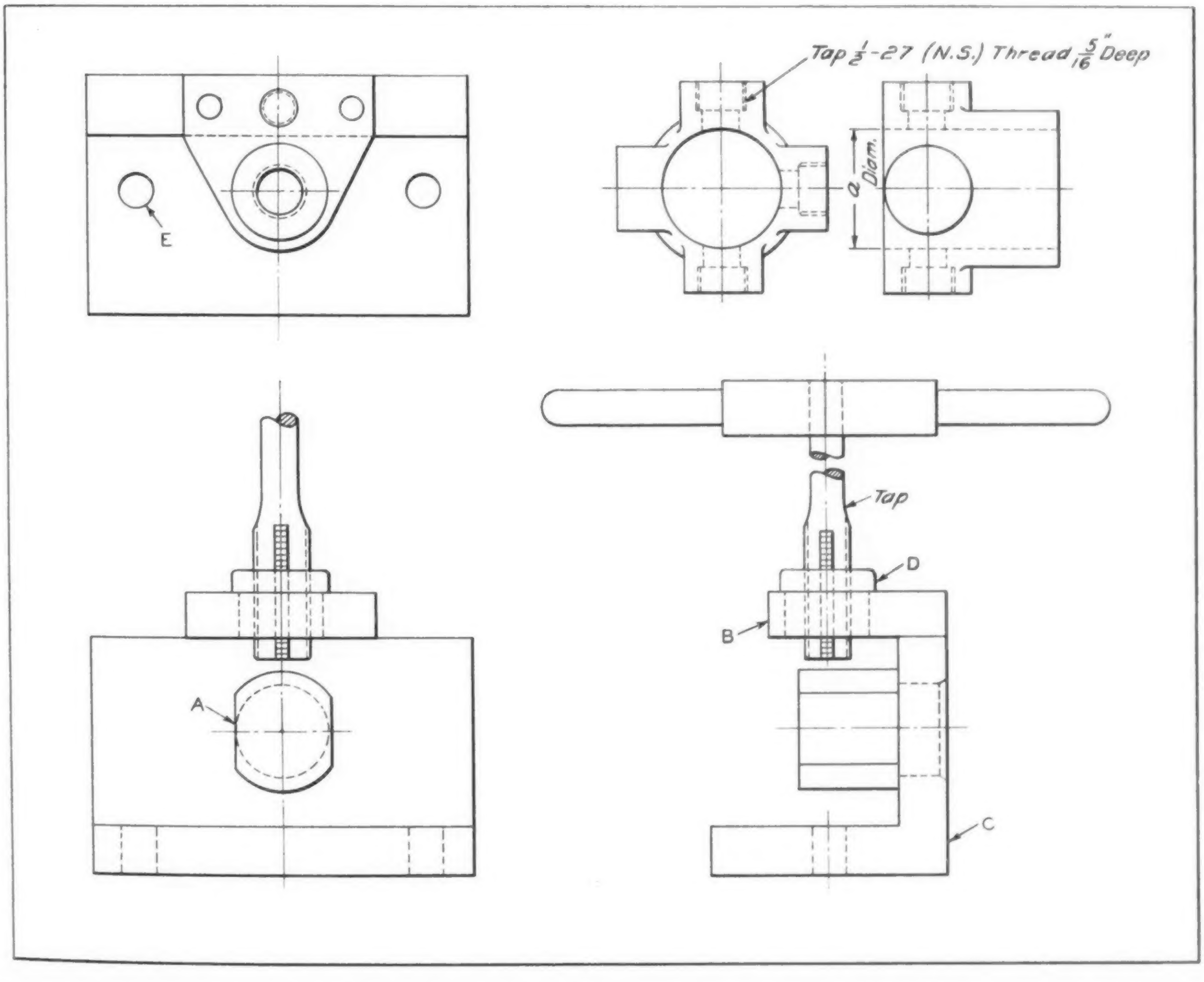
The mandrel *A* is a slip fit for diameter *a* of the piece and is cut away on each side to facilitate loading and unloading. Plate *B* is screwed and doweled to angle-piece *C*, bushing *D* being set in place and tapped with a standard tap. A standard hand tapping wrench was used to turn the tap in the fixture. The holes at *E* were used to secure the fixture to a bench. No clamps are used to hold the work in the fixture, it being deemed advisable to allow the reamed holes sufficient freedom to align themselves with the tap. In operation, this arrangement proved very satisfactory.

* * *

With the constantly increasing number of unskilled workers in the shops, centralized tool grinding becomes more and more important.

Tax Laws that Discourage Enterprise

Our tax laws should be designed to induce the cooperation of business and capital. Business men realize that tax burdens must be sustained and that they must be commensurate with the requirements of the time, but those burdens should be within reason, and the laws imposing them should be designed to distribute them equitably. Punitive measures aimed at successful men produce unfavorable reactions that are harmful to our industrial economy. The psychology of the times, of course, enters into this situation, and there is no doubt but that business is today prepared for and willing to accept, as a necessary outgrowth of the war effort, burdens far beyond what would be accepted without unfavorable reaction in normal times. I think it can be safely said that industry is not opposed to excess profits taxes, for example, but the imposition of taxes on normal income in the guise of an excess profits tax, which does not equitably distribute the burden, may destroy the favorable psychology now existing.—*Walter A. Cooper* in "A Sound Basis for Taxation"



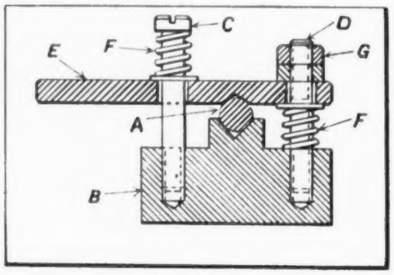
Fixture Used in Tapping Holes in Three Bosses of Piece Shown in Upper Right-hand Corner of Illustration

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Spring Clamp for Use in Grinding Tap Flutes

The clamp shown in the accompanying illustration was devised for holding the shanks of small taps while performing a very light flute-grinding operation. Speed, simplicity, and ease of operation, combined with sufficient gripping power, are features incorporated in the fixture. The tap shank *A* rests on a V-block *B*, into which are screwed two vertical studs *C* and *D*. A clamping bar *E* having a small vee in it is loosely mounted on the vertical studs.



Clamp for Holding Small Taps while Grinding Flutes

The two springs *F* provide the necessary compressive load for producing a wedging action of the vees on the tap shank. Two nuts *G* on stud *D* provide adjustment for various sizes of taps. The two holes in the clamping bar are large enough to provide clearance around studs *C* and *D*. In loading the clamp, bar *E* is lifted and a tap inserted. The clamping bar is then released, and the tap is held securely. B. M.

Making Taps Cut to Size by Changing Clearance

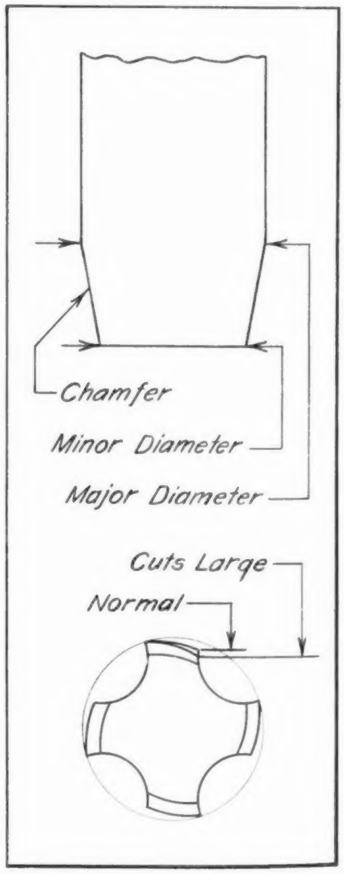
Tapping threads to size within the close tolerances required by a No. 3 or No. 4 fit is a factor of considerable importance in our war efforts. The use of a precision-ground tap will not, in itself, assure a thread of the required fit. The clearance at the back of the cutting edges on the chamfered end of the tap must be correct to obtain a thread of the desired size or fit.

Stainless steels and other harder or tougher metals require just enough clearance to permit free cutting, while aluminum, brass, etc., need a tap having more clearance. Taps obtained from different makers do not have the same clearance, and, hence, must usually have the clearance on the chamfered end, between the major and minor diameters — as shown in the accompanying illustration—reground to give the correct cutting size. In any case, if the tap cuts over size, the clearance should be reduced to nearly the normal amount, as indicated in the end view of the illustration. If a larger thread diameter is required, the clearance should be increased.

The diameter of the thread is determined by the first two or three threads of the tap. A little practice in grinding the clearance on these threads will enable one to grind the required clearance, free-hand, so that the tap will cut to size in the particular material being tapped. It is also desirable to hone the vee of the tap lightly with a triangular oilstone, honing toward the flute to remove any feather edge remaining after the flute is ground by the maker.

Chicopee Falls, Mass. STANLEY M. WHITE

* * *



Method of Changing Clearance on Tap to Control the Cutting Size

Under new plans recently announced by the British Minister of Production, Oliver Lyttelton, for the reorganization of the British war industry, many firms—large and small—will face further governmental control which will, in some cases, involve their removal to new locations. Firms not definitely tied to heavily congested districts may have to move their machinery and a few key workers, in order to operate in less congested districts. These plans indicate the extent of the mobilization of Great Britain's manufacturing resources for war production.

Getting the Best Results from Cutting Tools

Important Data on Tool Conservation and Performance, Based Upon a Symposium on the Cutting of Metals Presented before the Annual Meeting of the American Society of Mechanical Engineers in New York

At the annual meeting of the American Society of Mechanical Engineers, a symposium on cutting tools from the user's point of view was presented, at which engineers from a number of leading companies recorded the practices of their organizations. The companies represented were the Timken Roller Bearing Co., the Westinghouse Electric & Mfg. Co., the General Electric Co., the Warner & Swasey Co., and the Firth-Sterling Steel Co.

Conserving Cutting Tool Materials

The paper presented by H. A. Tobey, bearing plant metallurgist of the Timken Roller Bearing Co., was chiefly concerned with the conservation of cutting tool materials. The author emphasized that the first step in meeting the current machine tool scarcity is to use cutting tools in present machines that will give the greatest production. To do this, it is necessary to study each machine and its product, and to determine from what material the tools should be made.

Briefly, there are three groups of cutting tool materials: (1) High-speed steel, which may be grouped under four subdivisions—tungsten steels; low-tungsten molybdenum steels; 4 to 6 per cent tungsten with 4 to 6 per cent molybdenum steels; and cobalt steels. (2) Cast cutting tool alloys sold under trade names such as Stellite 2400, Tantung, and many other trade names. (3) Sintered carbides.

In order to maintain the required number of high-speed steel tools, the Timken Roller Bearing Co. has established the practice of making almost all types of high-speed steel cutting tools with inserts or tips brazed to a medium- or low-carbon steel shank. The brazing process is comparatively simple, and can be carried out in any shop having furnaces for heat-treating high-speed steel. The brazing is actually done during the heat-treating operation.

By using tips and inserts, the total consumption of high-speed steel is reduced approximately 75 per cent; in addition, this method opens up an untapped source of high-speed steel material, since the tips may be made from obsolete tools, tools ground down too short for the tool-holder, broken tools, and bar ends. All of these, in the past, were considered scrap, but now they are sorted as to grade, annealed (except that bar ends do not require annealing), and reprocessed into tipped tools. All types of lathe and boring-mill turning tools, forming tools, boring tools, reamers, cut-off blades for automatic machines, and numerous other types are made in this way.

A second method of conserving high-speed steel is by butt-welding. Although butt-welding is not so extensively used as brazing, some types of tools are made by this method, including double-end boring tools, in which a small piece of high-speed steel is butt-welded to each end of an S A E 1020 steel body. Another application is the butt-welding of a 1/2- by 1- by 1-inch piece of high-speed steel to a piece of SAE 1020 steel, 1/2 by 1 inch by 4 inches; the high-speed steel is then forged to a 1/8-inch thick cutting-off blade. This not only saves high-speed steel, but makes possible the use of a standard tool-holder.

A third method of conserving high-speed steel is through tool design. One of the most important examples of this possibility is the redesigning of the tool-holders in a number of applications to replace circular forming tools with flat tools. In a specific case, a circular tool required a piece of high-speed steel 6 inches in diameter by 3 inches long. The flat tool replacing this tool requires a piece of high-speed steel 1 1/2 by 3 by 4 inches brazed to an S A E 1020 steel body. This reduces the use of high-speed steel from 84 to 6 cubic inches.

Application of Cast-Alloy and Sintered-Carbide Cutting Tool Materials

Cast alloys for cutting tools are used almost entirely in the form of inserts or tips brazed to low-carbon or cast-iron shanks. These tools have a definite place in the tooling program between the high-speed steels and the carbides. They allow greater cutting speeds than high-speed steel, and are more easily ground than carbide tools.

The highest cutting speeds are, of course, obtained with carbide tools. The selection of the right grades of carbides for different conditions is of great importance. Valuable assistance in the selection of the proper grades can be obtained from the supplier of the carbide material, if he is informed of the service conditions.

Frequently, all the cutting tools for the machining of a piece of work can be made from carbides, except a large forming tool which may be made from high-speed steel. If the forming tool is fairly wide, this is the most economical procedure, because the grinding of a carbide tool to a certain form requires special wheels, and the grinding, at best, is relatively slow. Obviously, forming tools can be made to the correct form by the carbide producer before sintering; but since, in many instances, only one or, at best, very few forming tools are required to maintain production, it would be impractical to have the carbide tips formed before sintering.

Incidentally, it might be mentioned that the Timken Roller Bearing Co. has found a diamond-impregnated wheel the most satisfactory type for carbide tools.

Using Tool Set-Ups with Tools Made of Different Materials

L. B. Dorsner, manufacturing engineer of the Westinghouse Electric & Mfg. Co., in his paper reviewed the application of all the different types of cutting tool materials, and emphasized an important point: In many tool set-ups, it is advantageous to use a combination of cast-alloy or high-speed steel tools with carbide tools. This combination works successfully on the same operation, the cast-alloy or high-speed steel tools being applied on the smaller diameters, and the carbide tools on the larger diameters. In that way, all the tools operate at the cutting speed most suited for each.

The speaker also emphasized that Stellite and other cast-alloy tools were used successfully on automatic screw machines, where, in many cases, the carbide tools could not be efficiently applied because of insufficient speeds on small diameters and the use of sulphurized cutting oil. Since the cast alloys cannot be machined except by grinding, they do not lend themselves to the more intricate shapes of cutting tools; but in that case, tool set-ups can be arranged to use cast alloys wherever possible, and high-speed steel tools for cutting tools not advantageously made from cast alloys.

In machining steel with carbide tools, it is important that a correct type of chip-breaker be used. Without the chip-breaker, the chip will flow in the form of a continuous ribbon. Such chips are difficult to handle and dangerous to the operator. In many instances, they have been known to become twisted around the tool, even causing it to break. It is the Westinghouse practice, therefore, to grind a small groove in the face of the tool to serve as a chip-breaker. This type of chip-breaker causes the chip to curl and break off in small sections.

The various styles of cutting tools used, as well as the different kinds of metal being cut, make necessary modifications in the chip-breaker. If the grooves are ground too deep or too wide, and not in correct relation to the cutting edge, the chips are not curled, and the high pressure produced by the cutting speed will cause the cutting edge to break.

There are chip-breakers made with an additional piece which is either brazed or clamped on the top of the tool. This piece curls the chip into small spirals which break off; but the high pressure exerted by the hot chip gradually wears off this additional piece and the chip again flows in a long ribbon form. Another disadvantage of the separate chip curler is the tendency of the rapidly forming chip to force itself between the chip-breaker and the tool face, causing breakage of the cutting edge or damage to the chip curler. A chip-breaker groove ground into the top of the tool has given the best results.

Mr. Dorsner stated that it is impracticable to recommend speeds and feeds for carbide tools that would apply under all circumstances. High speeds are possible for light finishing cuts, but better results have been obtained by rather conservative speeds and feeds when an appreciable amount of stock is to be removed. The following speeds and feeds represent average Westinghouse practice:

Feeds and Speeds Used with Carbide Tools

Cast iron, roughing cuts up to 3/4 inch depth of cut: Cutting speed, 160 to 240 surface feet per minute; feed per revolution, up to 3/32 inch.

Cast iron, finishing cuts: Cutting speed, 180 to 240 surface feet per minute; feed per revolution, up to 1/32 inch.

S A E 1050 steel, continuous cut up to 5/8 inch depth: Cutting speed, 200 to 250 surface feet per minute; feed per revolution, up to 1/32 inch.

S A E 1050 steel, intermittent cut up to 3/8 inch depth: Cutting speed, 150 to 200 surface feet per minute; feed per revolution, up to 0.022 inch.

Heat-treated alloy steel, continuous cut up to 1/2 inch depth: Cutting speed, 175 to 200 surface feet per minute; feed per revolution, up to 0.025 inch.

Copper: Cutting speed, 600 to 800 surface feet per minute; feed per revolution, 0.11 to 0.18 inch.

L. T. Weller, laboratory engineer of the General Electric Co., spoke specifically on metal cutting with carbide tools. He emphasized the fact that the use of carbide tools has made it possible

in many cases to double and triple the output of machine tools. This means that fewer machines are needed for a given production. With rigid machines, it is possible to operate continuously one or more eight-hour shifts without any "down" time for sharpening tools.

Grinding wheel manufacturers have contributed in a large measure to the successful use of carbide tools. The manufacturers of silicon-carbide and diamond wheels have made it possible to grind tools with the required shape and keen cutting edges rapidly and at a cost equal to that of grinding a high-speed steel tool.

Importance of Centralized Tool Control Department

H. A. Oldenkamp and James MacFayden, of the Warner & Swasey Co., brought out, among other things, the importance of keeping an accurate and close check on all types of cutting tools used in the shop. In the Warner & Swasey plant, a centralized tool control department was started a few years ago for the main purpose of servicing carbide tools, and this department has been largely responsible for the application of various types of cutting materials. It is now operating twenty-four hours a day, and is servicing upward of 3000 carbide tools a day.

The tool-control and shop tool-design departments work closely together in choosing the proper tool for every job. These two departments consult each other and decide upon the design. Carbide is given first consideration because of its many advantages, except when the conditions may require another tool material.

Carbide tools are constantly being applied to operations regularly performed in the shop for which other tools have formerly been used. The procedure is to arrive at a proper tool design by experiment. The feeds and speeds used and other data are recorded and turned over to the shop tool-design department for permanent recording.

Extent of Application of Different Tool Materials

At the present time, carbides are used in the Warner & Swasey plant for 45 per cent of all operations, high-speed steel for 50 per cent, and Stellite for 5 per cent. In general, three grades of carbide tools are required—one for general-purpose work on cast iron; one for precision work on cast iron, especially for precision boring; and one for general-purpose work on steel.

As mentioned, carbides are used wherever possible. Up to the present, however, high-speed steel has generally been used for milling steel, although straddle- and face-milling of steel has been successfully done with carbide cutters, and is practically past the experimental stage. The finishing of the noses of spindles for turret lathes is still being done with high-speed steel, because the finishing must be done at too slow a speed for carbide tools. Higher speeds generate heat, which causes inaccuracies.

High-speed steel tools are also used on turret lathes for heavy intermittent cuts. For cutting-off operations, it has not been found practical to use carbide tools, because the tool is usually not wide enough to prevent "weaving." In spite of these limitations, about 80 per cent of the tools used in the turret lathes are carbide tools.

Use of Carbide Tools for Planing and Boring

One of the most recent applications of carbide tools in the Warner & Swasey plant has been on planers where a time saving of from 30 to 40 per cent has been effected, including the set-up. When the many hours usually spent in setting up a job on a planer are considered, these savings are remarkable. Carbide tools are now being successfully used on planers for roughing and finishing shallow grooves and dovetails. The success of the application of carbide tools to planers depends largely on the grinding of proper angles on the tools, so that they will withstand the impact of the cut.

High-speed steel is used on planers for making deep slots, because of the danger of the tool not clearing the work on the return stroke of the planer table. On side slots, where the operator must clear the tool from the work by hand, it still seems more practicable, from the standpoint of safety to both the operator and the tools, to use high-speed steel. Carbide tools are not suitable for short planer strokes, because the momentum of the planer table with higher speeds does not allow the table to reverse quickly enough for most jobs on which the short stroke must be used.

On horizontal boring machines, carbide-tipped tools have been successfully used. In one instance, on a large lathe bed, the over-all time was reduced from fifteen to five hours. Carbide boring tools have been found to be less expensive in initial cost than high-speed steel boring-bars. Repairs to carbide-tipped boring-bars are also less expensive.

Attention was also called to the fact that carbide tools wear more quickly when operated at too slow a speed than when operated too fast. At slow speeds the tip builds up rapidly, dulling the edge and causing breakage. When too high a speed is used, the cutter will become pitted and a crater will develop just behind the cutting edge. This, too, may cause breakage.

The shank material recommended for use with carbide tips is carbon steel of 0.45 to 0.65 per cent carbon. Successful results have also been obtained with cast-iron shanks, except in places where there is a large amount of shock. In general, the holders for carbide tools must be much sturdier than for high-speed steel tools.

MATERIALS OF INDUSTRY

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Coal Tar Pitch for Extinguishing Magnesium Fires

For use in extinguishing magnesium fires and incendiary bombs, the Waverly Petroleum Products Co., Drexel Blvd., Philadelphia, Pa., is now producing "Speedi-Out," a hard coal tar pitch. This product acts by cutting off the supply of oxygen from the burning bomb or magnesium. In a recent demonstration at a large aircraft plant, "Speedi-Out" completely extinguished a magnesium fire bomb in two minutes and fifty-three seconds.

This coal tar pitch compound is non-abrasive, non-corrosive, and non-toxic. It has a 6/35 mesh, with a softening temperature exceeding 300 degrees F. These specifications conform to the recommendations drawn up by the Bureau of Mines, United States Department of Interior. After the fire has been extinguished, the dry pitch can be readily chipped off............201

Plastic-Impregnated Fabric for Pattern Repair

A plastic that for years has given strength and resiliency to box toes of shoes now speeds production in foundries by affording quick, easy, economical repairs and alterations for patterns of metal castings. The product is a colloid-treated fabric known as "Celastic," and is manufactured by The Celastic Corporation, Arlington, N. J.

Double-napped cotton flannel, similar to a cotton blanket, is impregnated with cellulose nitrate and a fire retardant, making it slow-burning. When wet with a solvent, it may be formed into any shape, and will retain that shape on drying. It has good adhesive properties, and will stick to wood, metal, and other materials.

When a wooden or metal pattern is to be repaired or altered, a piece of "Celastic" is cut to the desired size and shape. The piece can be beveled to a feather edge. It is then wet with a solvent, and easily formed into the shape of the pattern with the fingers or a shaping tool. It has a hard, even surface on drying, and may be lightly sanded and shellacked to a smooth surface. "Celastic" will dry in twenty-five minutes with some solvents, but longer drying periods are recommended. The plastic may be reworked or removed entirely merely by wetting it with a solvent.

In tests at the Worthington Pump Co.'s plant in New Jersey, patterns formerly discarded but now repaired with "Celastic" have given satisfactory service for as many as 200 castings and still remained in excellent condition........202

Oakite Anodic Degreasing Material

An alkaline type material known as Oakite Composition No. 90, for anodic degreasing, or reverse current cleaning of cold-rolled steel parts before finishing, has recently been developed by Oakite Products, Inc., 26 Thames St., New York City. This new cleaning agent has high conductivity, ready adaptability to hard water conditions, effective smut removing properties, and fast wetting-out action. It is said to be particularly effective where a large volume of work is handled and where fast soil removal is essential. Among other applications, the material has been found advantageous in plating departments and contract finishing shops using the Bullard-Dunn process for the tin-coating of steel parts. 203

Sealing Compound for Synthetic Glass and Aluminum Joints

A compound especially developed to seal joints and seams in aluminum parts, as well as in synthetic glass, with no harmful effect to the latter material at any working temperature, has been announced by the Presstite Engineering Co., 3930 Chouteau Ave., St. Louis, Mo. Joints sealed with this compound are air- and water-tight, and will not permit passage of 100 octane gasoline, aircraft fuel, and motor oil. The sealing compound remains flexible, and does not lose its adhesion at extremely low temperature.

To obtain additional information about materials described on this page, see lower part of page 176.

The compound is made without volatile solvents, and is furnished in the form of an extruded ribbon with a cloth backing to facilitate its application. It is claimed to be non-corrosive, non-drying, non-hydroscopic, non-polymerizing, and permanently elastic. It is available in widths of from 0.625 inch to 2 inches, and in thicknesses from 0.020 to 0.125 inch........204

Colonial Alloys Introduces Group of Three Plastics

A series of three plastics called Colonial "V" plastics is being manufactured by the Colonial Alloys Co., E. Somerset, Trenton Ave., and Martha St., Philadelphia, Pa. These plastics are available in the form of tubing, pipe, monofilaments, multi-filaments, rod, shapes, general extrusions, tapes, injection moldings, and compression moldings. When used in place of rubber, they are claimed to provide a higher resistance to aging, abrasion, sunlight, oils, gasoline, and acids. Their properties indicate many possible uses as substitutes for copper, tin, aluminum, Monel metal, stainless steel, and other critical materials. 205

Compound for Removing Rust, Scale, and Burn Marks

A new compound called "Corrosol 26" has been developed by the International Rustproof Corporation, 12507-15 Plover Ave., Cleveland, Ohio, to remove rust, scale, and burn marks from machine parts. This compound is used in a cold solution. Metal surfaces treated with this compound are not susceptible to corrosion after treatment, but are left in a clean, passive condition. 206

"Pro-Tek"—An Infection-Protective Cream for Workers' Hands

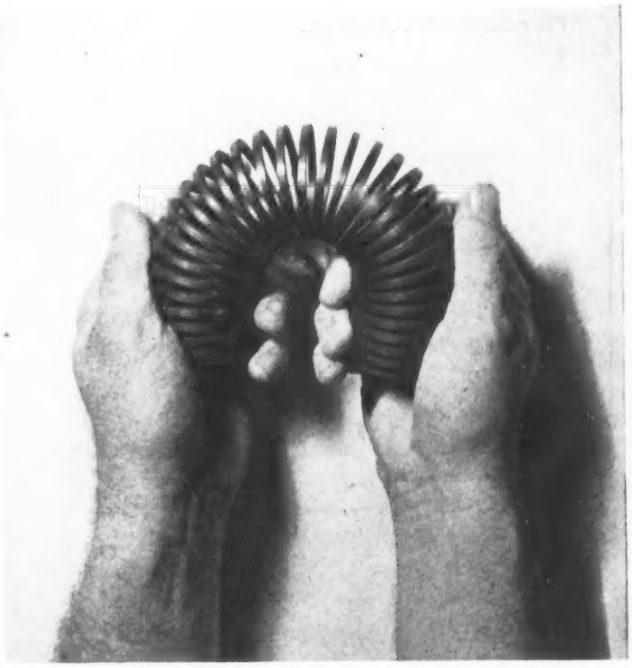
Industrial skin infections, which according to the statistics of a major insurance company comprise two-thirds of all occupational diseases, can be largely prevented by the use of protective creams for the workers' hands. In plants where hands are exposed to oil, grease, solvents, or paints, these protective films have proved very effective. Application of such protection to the hands has been made compulsory in many plants, because it eliminates much of the lost time due to dermatitis.

One such protective compound is a greaseless substance known as "Pro-Tek" cream, manufactured by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. It is applied to the hands, arms, and under the nails before starting work, and forms an invisible film which gives protection against contaminated oils and other irritating substances. At the end of the working period, this film can be washed off with soap and running water, the grime on the workers' hands also being removed with it................207

Meehanite Cast Iron Used for Diesel-Engine Crankshafts

Under the pressure of war work, the Cooper-Bessemer Corporation, Mount Vernon, Ohio, is using Meehanite cast iron for Diesel-engine crankshafts to supplement the use of forged-steel crankshafts. In order to test some of the characteristics of the Meehanite cast iron, a helical spring was cut from it. This spring could be bent, as shown in the accompanying illustration. It returned to its original shape each time it was bent. This cast-iron spring is kept on display in a showcase at the company's plant, so that any skeptical visitor may have a convincing demonstration of the flexibility of Meehanite cast iron.

The Cooper-Bessemer Corporation has had Meehanite cast-iron crankshafts in service for six years. These shafts range in diameter from 3 to 9 1/2 inches. It is stated that they have given complete satisfaction. 208



This Illustration Shows how Flexible Cast Iron can Really be. The Spring was Cut from a Cylindrical Casting Made of Meehanite Metal, which is being Used in Castings by the Cooper-Bessemer Corporation of Mount Vernon, Ohio

To obtain additional information about materials described on this page, see lower part of page 176.

You Can't Work Unless You Can Get There

What Can the Management of a War Production Plant do to Help Solve the Workers' Transportation Problems Arising from Gasoline and Tire Rationing? How Can the Threat of Employe Absence and Consequent Production Loss be Met? Here is the Story of One Plant's Outstanding Achievement in Handling This Situation

WITH national gasoline rationing and severe tire restrictions in force, war workers everywhere are facing increasing difficulties in getting to and from their plants. Delay in securing supplementary gasoline and ration books, worn-out tires, and overtaxed public service facilities may result in considerable absence from work and loss in production.

At the East Springfield plant of the Westinghouse Electric & Mfg. Co., many of these difficulties were anticipated early in the initial period of eastern seaboard gasoline rationing. Several vigorous steps were taken to meet them. Under the direction of Stanley Paluch, supervisor of stores and plant transportation, a tire and gasoline conservation committee was established, and a comprehensive survey was made of the transportation situation at this plant.

In making this survey, the first step was to find out what were the riding habits of the employes. This information was obtained through the questionnaire shown in Fig. 1, which was printed on 4- by 6-inch cards and sent out by payroll clerks and office supervisors to everyone in the plant.

The second step was to enlist the services of the plant police department in taking a census of all cars parked in the plant area, including company parking lots, private parking lots, private garages, public garages, and street curbs. This census covered all shifts and provided a partial check against data gathered by means of the questionnaire.

The third step was to station members of the police department at strategic points around the plant, where they could survey the employes' cars as they were driven to work and could count the number of passengers in each. About 290 cars of the total number were checked in this manner, in order to further verify the questionnaire data.

The fourth step was to engage a tire expert from a local concern to survey the tire conditions of a num-

WESTINGHOUSE WAR PRODUCTION DRIVE
EAST SPRINGFIELD WORKS
TIRE AND GASOLINE CONSERVATION COMMITTEE—BULLETIN

TRANSPORTATION QUESTIONNAIRE

Let us help you solve your transportation problem, caused by the tire and gasoline shortages.

Please answer the following questions:

1. Where do you live? ________ How many miles is it to and from work? ________
2. Which of the following means of transportation do you depend on: Auto ____ Bus ____ Train ____ Walk ____
3. If you travel by car, do you drive your own car? ____ Or do you ride with a friend? ____
4. If you drive your own car, how many people ride with you? ____ Would you be willing to carry additional people? ____
5. What is the year ____ and type of your car? ____
6. Give an estimate of mileage left in your present tires. ____ miles.
7. If you cannot replace your present tires when they wear out, what means of transportation could you depend on to get to and from work? ________
8. How far from your home is the nearest means of transportation? ________
9. What shift are you working on? Start: ____ Stop: ____
10. Would you care to ride with someone else? ________

PLEASE RETURN THIS QUESTIONNAIRE TO YOUR FOREMAN

Fig. 1. Questionnaire Sent out to Each Employe in an Endeavor to Ascertain His Riding Habits

WORK TOGETHER -- RIDE TOGETHER
SWAP A RIDE FOR VICTORY

Today your tires were checked by a tire expert.
He estimates that the mileage left in your tires
is only________miles.

****

Put in here
the average
miles you drive ________ - miles left in your tires
per day
then divide

The answer to this problem shows you how many days your
car will still bring you to work on your present tires.

SWAP A RIDE FOR VICTORY

Card No. 2 "OVER" War Production Committee

Fig. 2. Card Left in Employe's Car after Tire Examination. Calculating Scale on Reverse Side of Card Makes Possible a Quick Determination of Expected Life of Tires

VICTORY

ber of employes' cars parked in the company lot. This survey was made to estimate the average tire life which might be expected for each of these cars. The estimate was made with the optimistic assumption that the owners were going to drive more slowly than in normal times and would take better care of their tires. Some 240 cars were examined, and the card shown in Fig. 2 was left in each. This served to call the attention of the owner to the maximum length of time he could expect to use his car for getting back and forth to work.

As a result of the information secured through (1) the questionnaire, (2) the car census, (3) the passenger census, and (4) the tire inspection, the following composite picture of the transportation situation at the East Springfield plant was developed.

About 55 per cent of the employes at this plant were dependent upon private cars for transportation. This was a large enough percentage, certainly, to warrant careful planning in order to insure that some mode of transportation would be available to them should many of these cars have to be laid up. About 20 per cent of the employes used public transportation facilities, and about 25 per cent either walked to work or used bicycles.

Looking now at the private car situation, it was found that each car was carrying an average of 1.8 passengers; in other words, 2360 employes were coming to work in 1311 cars. Obviously, it was desirable to do something to increase the number of average riders per car, thus reducing the number of cars in use.

The average distance driven by the employes at this plant to and from work was 14 miles a day, or 4200 miles a year based on 300 working days. The tire survey showed that the average life of the tires on the cars inspected was slightly over 8000 miles. Assuming that the tires inspected gave a fairly accurate indication of the condition of all the tires being used by employes in driving to and from work, the average tire life expectancy was about two years. By the time this period had elapsed, about 52 per cent of the employes' cars would be off the road if new or recapped tires were unavailable.

It was also estimated that about 38 per cent of them would be off the road before the end of 1942 because of tire failure. It should be borne in mind

TIRE & GAS CONSERVATION COMMITTEE

FOR DRIVER ONLY
TICK MARK READING
ZONE SHIFT NO. OF RIDERS ROOM FOR

NAME

ADDRESS PHONE

SHOP INFORMATION

DEPARTMENT BADGE PHONE

FOREMAN OR SUPERVISOR

TIRE & GAS CONSERVATION COMMITTEE

FOR RIDER ONLY

ZONE TICK MARK READING SHIFT

NAME

ADDRESS PHONE

SHOP INFORMATION

DEPARTMENT BADGE PHONE

FOREMAN OR SUPERVISOR

Fig. 3. Record Cards for Driver and Rider, which are Filed by Department, Shift, and Home Location. These Facilitate Contact between Drivers and Prospective Passengers

that these figures were based solely on the amount of driving done in going to and from work, and did not make any allowance for personal driving. They were, therefore, probably quite optimistic.

First Objective was to Reduce Number of Cars in Use

One of the first objectives was to increase the average number of passengers riding in each car, so that the number of cars needed would be reduced. Based on data previously obtained, a card was made out for every driver in the plant, showing how many passengers were being carried in his car and what, if any, extra space was available. A street map of the city and a map of the surrounding communities were marked off into zones. Each driver's card was marked with the zone in which the car driver lived. Another series of cards was made up for every rider in the plant. Both driver and rider cards were filed by department, shift, and zone. These cards are shown in Fig. 3.

An appeal by poster and bulletin was then made to all employes to get together and pool their rides. The posters used in this campaign are shown in Fig. 5. Those who could not find anyone to ride with were invited to get in contact with the committee, which would use its card file to put the rider in touch with several drivers who worked on his shift and who also lived in his zone. The average number of riders per car gradually rose to 3.5, with a consequent drop in the number of cars being used and with a considerable saving of gasoline and tires. Another survey at the end of three months showed that only 929 cars were being driven to work, compared with 1311 at the beginning of this period. During the same period, employment at the plant had increased by 1700.

SWAP A RIDE FOR VICTORY

This form is to be completed by every Westinghouse employe. The Federal Government and the Company need this information. Return the card to your foreman or supervisor within three days.

1. Name ______ Dept. or Section ______ Shift ______
2. Home Address ______ (No. / Street / Town / State)
3. Do you drive to work? ____ Miles per round trip per day? ____ mi.
4. If you drive, how many other employes ride with you? ______
5. If you drive, would you be willing to swap rides? ______
6. If you drive, could you get to work by other means? ______
   Bus__ Train__ Street car__ Bicycle__ Walk__
7. If you do not drive, how are you coming to work?
   Bus__ Train__ Street car__ Bicycle__ Walk__

SWAP A RIDE FOR VICTORY

Transportation
Census Card No. 1 — War Production Committee

Fig. 4. This Questionnaire is Filled out by Each New Employe, so that Arrangements Can be Made for His Transportation to and from Work

VICTORY

Those employes who believed it necessary to obtain supplementary gasoline ration books were aided in making out their applications. Before being submitted, these were examined by the committee for accuracy and completeness. An attempt was made to find a means of getting the applicant to and from work without requiring the added gasoline ration. If this failed, the application was certified and sent directly to the local rationing board.

This committee had previously gotten in touch with each local rationing board and informed them of the service it was providing for the Westinghouse employes. It was made clear that the committee would certify an employe's application for additional gasoline rationing only when it had established that no other form of transportation was available to the employe and that the amount of additional gasoline requested was justified by his needs. Only the committee chairman was authorized to certify these applications. In almost every case, the application was approved by the local rationing board at once, and the employe received a notice that his supplementary book would be available within one or two days.

This procedure was of considerable benefit to both the employes and the local rationing boards. Formerly, employes had had to wait for two or three weeks because of the large number of applicants who were unknown to the board and whose applications had to be carefully checked and verified.

In one particular case before the committee started to function, an employe had his application returned three times because it was incorrectly filled out. Other employes had had to use their gasoline to go to the gasoline rationing board, and had been absent from the plant for this purpose.

One specific example of the value of this com-

mittee's work was the case of a high-grade machinist. This man was interviewed and hired early in the week, and wanted the remainder of the week off to find some form of transportation to and from work. He lived in a community about fifteen miles outside of Springfield. The employment manager got in touch with the committee chairman, and in about five minutes' time, the names of fifteen employe car owners living in the same community and working in the same shift were made available for contact. This whole plan has worked out so successfully that the questionnaire form shown in Fig. 4 is now filled out by every new employe.

This committee was also successful in getting a local transportation company to set up new bus lines to the plant. Before approaching the transportation company, a survey was made to determine the number of workers coming from each community on each shift. It was found that from one town six miles away there were 69 cars being used, carrying 311 people. From another town seven miles away, 16 cars were being used, carrying 43 people. From another town five miles away, 37 cars were being used, carrying 127 people, and so on. These employes were gotten in touch with and agreements secured to utilize the bus service proposed, if satisfactory schedules and fares could be arranged. The committee was thus able to guarantee to the transportation company that it would have a certain minimum number of passengers from each community.

A sliding scale of fares was worked out, beginning with this minimum number and decreasing with each added increment in number of passengers carried from the community in question. Schedules were arranged, printed, and distributed to the employes in these communities. These schedules were so established that the employes were brought to the plant just before the start of their shift, and buses were ready to take them home when they had completed the day's work. As soon as the new bus service was introduced, the respective local rationing boards were notified, so that other residents in these communities who were working in Springfield might also take advantage of the new bus lines.

Arrangements were made with the local street railway to revise its schedules so that better connections could be made with buses going to the plant. This was particularly helpful to employes living in outlying parts of the city.

Fig. 5. Series of Posters Used to Stimulate Employes to Swap Rides and Use Fewer Cars. Average Number of Passengers per Car Increased from 1.8 to 3.5 in Three Months

The Superintendent of Streets was gotten in touch with, and it was suggested that certain highways leading to the plant be graded to cover up car tracks that were not in use. Thus a hazard to tires was removed.

Those employes who, by necessity, drove to work were aided in finding the shortest and best route to and from their homes. Certain key men had been accustomed to using their own cars to travel to the plants of sub-contractors. The management was persuaded to provide company cars for this purpose.

This committee is also helping employes who made supplementary gasoline ration applications for purposes other than that of driving to work. In cases of illness, for example, where regular visits to a hospital are required, or for civil defense duties, the committee has been able

to help the employe secure his needed gasoline ration quickly.

The committee is also certifying requests for recapped tires, another service that is expected to save the employes much delay.

Looking into the future, this committee has even considered the remote possibility that no private automobiles would be available for its employes to drive to work. In the event of such a contingency, the possibility of using special coaches converted from sedans, each of which would carry fifteen passengers, is under consideration. Employes might act as voluntary chauffeurs, and regular routes would be covered to pick up the workers on each shift.

* * *

Replacing Cast-Iron Guard with One of Sheet Steel

By H. A. OLDENKAMP, Welding Consultant
Warner & Swasey Co., Cleveland, Ohio

The use of fabricated sheet metal for certain parts of machine tools is rapidly gaining recognition as an important means of conserving metals, speeding up production, reducing weight, and cutting costs. All of these advantages were realized in a recent change-over from cast iron to welded steel for the rear spindle guard on the Warner & Swasey 1-A turret lathe. The new sheet-steel guard is completely spot-welded, and yet retains the smooth appearance of the former cast-iron guard, as shown in Fig. 1.

Clamping type fasteners are used on the new guard in place of set-screws, thus eliminating the boring and reaming of the holes for the mounting studs. Details of the mounting method are shown in Fig. 2. The end bell is a stamping, which is lapped to fit the main part of the guard, and spot-welded in place.

The new guard weighs 9 pounds, compared to 29 pounds for the cast-iron guard which it replaces. In addition, about an hour's machining and assembling time is saved, as no machining is necessary on the sheet-steel guard, and it can be put in place on the lathe more quickly than the cast-iron one.

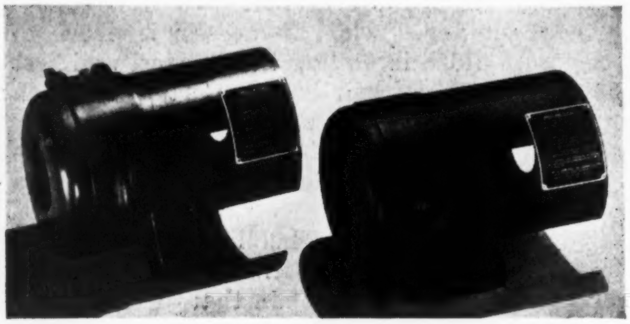


Fig. 1. Cast-iron Guard Shown at Left Replaced by Sheet-steel Guard at Right

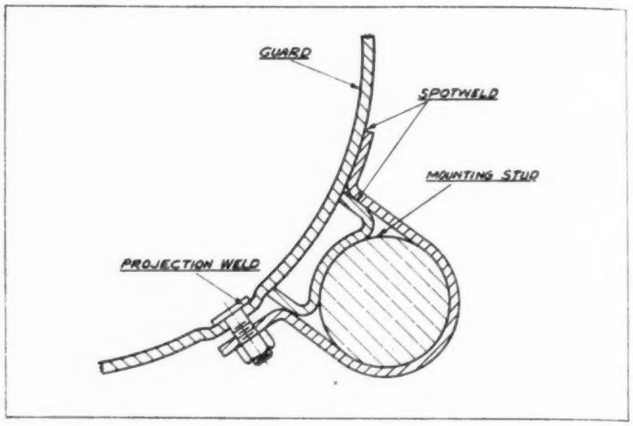


Fig. 2. Cross-section View, Showing Method of Mounting Sheet-steel Guard

* * *

Heat-Treatment of National Emergency Steels

A great many questions are being asked by men engaged in manufacturing operations with regard to the new National Emergency (NE) steels. Many users of these steels have been unable to obtain simple, direct information on their heat-treatment and properties that would help them to obtain the full benefits from these steels. For that reason, a new booklet on these steels, which has just been published by Joseph T. Ryerson & Son, Inc., 2558 W. 16th St., Chicago, Ill., will be welcomed by many manufacturing executives. It deals in a practical, simple way with the selection and heat-treatment of NE steels. The booklet is prepared in such a way that it is readily understandable by practical men, since it gives information and explanations in non-technical language.

The Jominy end-quench hardenability test, a quick method of determining the results of heat-treatment, is explained step by step. Because this test is the simplest and quickest way of determining hardenability, the Technical Committee of the American Iron and Steel Institute has adopted it as standard for the testing of NE steels. This test is easy to make and accurate, but the interpretation of the test results has puzzled many steel users. The booklet will help to simplify and clarify this subject, since it includes tables for converting Jominy test results into tensile strength, yield point, elongation, reduction of area, etc.

* * *

Speed and precision will win the decision.

How Tool-Design Service Organizations Speed War Production

By H. E. LINSLEY
Wright Aeronautical Corporation

ALMOST every plant engaged in war production has expanded greatly during the present emergency, and as a result, has experienced serious difficulty in the matter of new tooling. The problem of obtaining an adequate supply of productive labor has been fairly well solved through the short, intensive training courses established by the vocational schools and by industry. One of the most important factors in this solution has been the simplification of methods, and the employment of tools and fixtures so designed as to be capable of producing quantities of parts to the most extreme limits of accuracy without demanding more than normal skill on the part of the worker.

Obviously, however, this has resulted in a serious shortage of tool and methods engineers, a shortage that cannot be met by any quick training program, since many years of practical experience are essential in the education of men of this type. Fortunately, there has come into being during recent years an increasing number of tool-design service organizations, most of whom are well equipped to handle all phases of tool engineering, including plant layout, tool design, and methods engineering. Some of them are prepared to attend to the actual manufacture of tools, either in their own plants or through outside contractors.

To the manufacturer with a small plant, this service offers particular advantages, especially if his war contracts call for the production of articles radically different from his normal product. In many cases, consumer goods were made in relatively small quantities to fairly wide manufacturing tolerances, and by well established procedures. Faced with the demand for quantity production to extremely close limits, and an entirely new product, such a manufacturer frequently finds himself in serious difficulty. Speed is of the utmost importance, yet obviously, he could not afford to place on his payroll the number of tool engineers required, even if these men were available.

Furthermore, he is faced with the fact that such men as are obtainable are unwilling to accept a position that is only temporary. Under such conditions, the tool-design company's engineers are prepared to visit his plant, survey his equipment, recommend or design new machines, and prepare a lay-out planned for maximum output. In addition, they will design all the necessary tools and fixtures, prepare operation sheets, and, if desired, superintend production.

Compensation for these services varies with different companies; but, in general, the practice is to charge for work performed on a straight hourly basis. Over-time may be worked as necessary, but is charged for on the straight time basis to avoid any suggestion of favoring one customer's interests over those of another. Their extensive experience, covering many fields of work, enables these engineers to view each new job with an open mind, and to suggest new, but tried and proved, production procedures.

Still another service rendered by these companies is the making of recommendations for new types of work. Frequently, when surveying a plant, they are able to suggest additional lines of work which could well be handled with the equipment available.

This type of service can be, and is, of equal value in larger plants. Where drafting-rooms are already filled to capacity, the availability of the service company's floor space and equipment is of great advantage. When space within the plant can be found, the service organization's employes can work in the closest contact with regular employes and with the job itself, a factor that often effects a substantial saving in time and permits direct supervision of the work by the regular production engineer. When space does not permit all the service company's men to work inside the plant, the detailing can be done in the office of the service company, and then checked by the plant's own checkers.

It is not contended that the service company should replace the regular staff of methods engineers and tool designers in the larger plants, but rather that it should supplement their work. In this way, the regular staff that has an intimate knowledge of the plant and equipment may be used in an advisory or supervisory capacity.

Decentralization—the opening of branch plants, often in remote parts of the country—sometimes presents a serious personnel problem through difficulties of housing, transportation, and personal preferences. The service companies, however, located in the larger centers, are frequently able to hire first-class local men.

To summarize, the tool-design service company offers experienced service without investment for equipment and without the cost of labor turnover. It solves the problem of the increased supervision necessary when the staff is expanded, and avoids hours of time in training or correcting the work of new men. Its services can be utilized in plants of any size.

NEW TRADE LITERATURE

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 175 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the January Number of MACHINERY

Gages and Measuring Instruments

ALLEN GAUGE & TOOL CO., 421 N. Braddock Ave. (21), Pittsburgh, Pa. Catalogue covering the line of gages and measuring tools made by this company, including ground-thread plug and ring gages, alignment telescope gages, Borescopes, lead gages, thread height gages, thread taper gages, dial indicator checkers and calibrators, etc. 1

Aids to Grinding

NORTON CO., Worcester, Mass. Circular entitled "The 'Know-How' of Grinding," listing the motion pictures, training course, and informative literature brought out by the company with the object of helping grinding machine operators and others concerned with grinding operations to get greater production from their machines. 2

Shears, Hammers, Cranes, etc.

WHITING CORPORATION, Harvey, Ill. Catalogue 236, entitled "Whiting Products for Industry," illustrating typical examples of the varied line of products made by this company, including Quickwork-Whiting rotary shears and power hammers, cranes, foundry equipment, railroad and aviation equipment, special machines, etc. 3

Small Tools

INVINCIBLE TOOL CO., 611 Empire Bldg., Pittsburgh, Pa. Bulletin entitled "Can You Afford to Gamble with Production Delays?" covering the line of tool attachments made by this company, including angle tool attachments, deep-hole drilling tools, milling heads, etc. 4

Milling with High-Speed Steel

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio. Booklet M-1160, discussing the milling of high-speed steel, covering cutter design; mounting of cutters and work; speeds and feeds for high-speed steel milling cutters; a tion of cutting fluids; and care of cutters. 5

Metallizing Equipment

METALLIZING CO. OF AMERICA, 1330 W. Congress St., Chicago, Ill. Bulletin entitled "Mogul Metallizing Process and Equipment," describing this process and how it has been applied to problems relating to salvage, conservation of materials, and the use of substitute metals. 6

Decimal Equivalent Charts and Calendars

DAYTON ROGERS MFG. CO., 2835 Twelfth Ave. South, Minneapolis, Minn., is distributing 1943 calendars with decimal equivalent charts in two sizes—12 by 15 inches and 7 by 9 1/2 inches—to engineers, draftsmen, and war production executives. 7

Industrial Lubrication Equipment

ALEMITE DIVISION, STEWART-WARNER CORPORATION, 1826 Diversey Parkway, Chicago, Ill. Catalogue containing 50 pages of data on industrial lubrication equipment, including a selection guide for various requirements. 8

Electrical Control Devices

SQUARE D CO., Department 23, 4041 N. Richards St., Milwaukee, Wis. Catalogue containing detailed descriptions and engineering information covering the line of electrical control devices made by this company primarily for aircraft and tank use. 9

Wire and Cable Printing Machines

YORK ELECTRIC & MACHINE CO., INC., 1241 W. King St., York, Pa. Bulletin descriptive of a wire and cable printing machine by means of which wire and cable manufacturers can print their names on their products. 10

Handbook on Electric Drill Use

BLACK & DECKER MFG. CO., Towson, Md. Handbook on the proper use and care of portable electric drills, designed to assist new workers, especially in war-industry plants, to obtain the greatest efficiency and longest life from these tools. 11

Automatic Control for Contour Shaping Operations

DETROIT UNIVERSAL DUPLICATOR CO., 723 E. Milwaukee Ave., Detroit, Mich. Bulletin 5, describing how the Duplimatic—an automatic machine tool control—simplified the performance of a difficult contour shaping operation. 12

Marking and Brazing Tools

IDEAL COMMUTATOR DRESSER CO., 1285 Park Ave., Sycamore, Ill. Circular descriptive of the Ideal electric marker, a small marking tool used like a pencil. Circular describing Ideal electric brazers for brazing and soldering with silver solder. 13

Aids for Lathe Operators

SOUTH BEND LATHE WORKS, South Bend, Ind. Circular 21-C, containing a brief description of the motion picture films, instruction books, bulletins, wall charts, and blueprints on lathe operation prepared by this company. 14

N.A.S. Standards for Internal Wrenching Bolts

HOLO-KROME SCREW CORPORATION, Hartford, Conn. Catalogue containing tables of standards for internal hex wrenching bolts adopted by the National Aircraft Standards Committee. 15

Cooling Fluids and Cutting Lubricants

OAKITE PRODUCTS, INC., 26 Thames St., New York City. Treatise on "Cooling and Lubricating the Tools that Make the Tools of War," published as part of the "Oakite News Service." 16

Maintenance of Chain Drives

LINK-BELT CO., 307 N. Michigan Ave., Chicago, Ill. Folder 1951, entitled "First Aid for Faithful Chain Drives," telling what to do to keep chain drives running when it is impossible to get repairs or replacements. 17

Hand Punch Presses

LESLIE WELDING CO., 2943 Carroll Ave., Chicago, Ill. Bulletin 941, descriptive of the Leslie positive-alignment, hand-operated punch press developed for short production runs on large-size sheets. 18

Standard and Special Taps

DETROIT TAP & TOOL CO., Butler St., Detroit, Mich. Catalogue 22 (134 pages), covering the company's line of standard and special taps, thread milling cutters and other forms of threading tools, thread gages, etc. 19

Grinding and Polishing Equipment

MINNESOTA MINING & MFG. CO., St. Paul, Minn. Bulletin describing newly developed equipment incorporating the use of surface-coated abrasive belts for producing faster finishes. 20

Alternating-Current Welders

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Bulletin B-3136, descriptive of Flexarc alternating-current welders, designed to increase the speed of welding. 21

Hydraulic Presses

HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio. Bulletin 4206, descriptive of hydraulic Fastraverse metal-working presses. Bulletin 4207, on hydraulic presses for the process industries. 22

Safety Switches

FEDERAL ELECTRIC PRODUCTS CO., 50 Paris St., Newark, N. J. Bulletin 42-12, describing the new Rolarc 575-volt safety switch designed to cut down lost time caused by switch failure. 23

Cutting-Tool Guide

GENERAL TOOL & DIE CO., 555 Prospect St., East Orange, N. J. Wall chart entitled "A Guide for the Proper Choice of Cutting Tools," listing the proper tool for different classes of work. 24

Lighting Equipment

FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio. Bulletin entitled "To America's Women," telling how good lighting in industrial plants speeds production and cuts down rejections. 25

Annealing Machines for Steel Cartridge Cases

MORRISON ENGINEERING CORPORATION, Cleveland, Ohio. Bulletin 261, descriptive of a new flame type, mouth and taper annealing machine for cartridge cases. 26

Universal Cutter-Grinders

BERCO MFG. CO., 429 W. Superior St., Chicago, Ill. Bulletin illustrating and describing the Hilco universal cutter-grinder with index dividing head for sharpening any type of cutter. 27

Welding of Thin Metals

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin B6049A, de-

To Obtain Copies of New Trade Literature

listed on pages 174-176 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

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scribing the use of the Weld-O-Tron for welding metals as thin as 32 gage, or 0.01 inch. 28

Hydraulic Milling Machines

CINCINNATI MILLING MACHINE Co., Cincinnati, Ohio. Catalogue M-1018-2, illustrating and describing Cincinnati 28-inch series vertical Hydro-tel milling machines and attachments. 29

Arc Welding without Preheat

AMPCO METAL, INC., Milwaukee, Wis. Engineering Data Sheet No. 107, describing arc-welding without preheat to repair brass and bronze castings. 30

Labor Incentive System

THE BEDAUX CO., INC., Chrysler Bldg., New York City. Booklet entitled "Labor Wants to Produce," calling attention to methods for incentive payments. 31

Shoulder Thumb-Screws

OHIO NUT & BOLT CO., 600 Front St., Berea, Ohio. Catalogue Sheet 11-42, on shoulder thumb-screws, made in one piece by a cold-forging process. 32

Tool Steel

JESSOP STEEL CO., Washington, Pa. Bulletin 642, giving analysis, applications, heat-treatment and physical properties of Jessop R. T. water-hardening tool steel. 33

Plastic Piping and Tubing

DOW CHEMICAL CO., Midland, Mich. Circulars giving information on the characteristics of plastic tubing and pipe known by the trade name "Saran." 34

Strain Gages

BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa. Bulletins covering, respectively, SR-4 strain gage, SR-4 strain recorder, and SR-4 portable strain indicator. 35

Pneumatic Tools

DALLETT CO., Mascher and Lippincott Sts., Philadelphia, Pa. Bulletin 2241, on Dallett pneumatic tools for metal-working maintenance, and special uses. 36

Hydraulic Pumps

HYDRA-MOTIVE, INC., 723 East Milwaukee Ave., Detroit, Mich. Leaflet Hy-2, illustrating and describing infinitely variable delivery hydraulic vane pumps. 37

Carbide Tools

FIRTH-STERLING STEEL CO., McKeesport, Pa. Circular entitled "Firthite Leads the Way to Increased Production." 38

Air Painting Equipment

PAASCHE AIRBRUSH CO., 1909 Diversey Parkway, Chicago, Ill. Booklet FM9-42, descriptive of Paasche manual air painting equipment. 39

Trucks, Tractors, and Trailers

MERCURY MFG. CO., 4044 S. Halsted St., Chicago, Ill. Bulletin 230, on Mercury "approved model" trucks, tractors, and trailers. 40

Hard-Surfacing Material

EUTECTIC WELDING ALLOYS CO., 40 Worth St., New York City. Bulletin 185, on hard-surfacing of worn parts with "Durface." 41

Lubrication Handbook

NASSAU LABORATORIES, Hackensack, N. J. "Graphite Lubrication Handbook"—a guide to increased war production for engineers. 42

* * *

University of Iowa Offers Motion and Time Study Films

The State University of Iowa announces the availability of sound, motion, and time study films for use in training programs given by industry, colleges, and the United States Office of Education. These films show examples of motion economy applications to many different types of factory and office operations resulting in increases of output as high as 300 per cent. The films can be obtained on a loan basis. Those interested can obtain further information by writing to the Bureau of Visual Instruction, State University of Iowa, Iowa City, Iowa.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 177-200 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in January, 1943, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 166-167, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in January, 1943, MACHINERY.

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Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Fig. 1. Machine Shown in Fig. 2 Set up for Sharpening Segments of Flat Surface Broach

Colonial Universal Broach-Sharpening Machine

A universal broach-sharpening machine which will handle either round or flat broaches has just been brought out by the Colonial Broach Co., Detroit, Mich. This machine is designed to provide a rapid and accurate means for duplicating the original tooth forms of broaches, so that the cutting efficiency of the tools can be maintained. Thus shops equipped with this new machine save the time otherwise lost in returning broaches to the manufacturer for sharpening, and in some cases eliminate the need for purchasing spare broaches for use while one set is being sharpened.

The machine will accommodate flat broaches, as shown in Fig. 1, or round broaches, as illustrated in Fig. 2. Flat broaches up to 65 inches in length between the end teeth, and round broaches up to 72 inches between centers and 6 inches in over-all diameter can be sharpened. The change-over from round to flat broach sharpening is accomplished with few adjustments and without special tools. In the set-up shown in Fig. 1, the flat-surface broach segment to be ground is mounted on a magnetic chuck and the grinding wheel head is given the required transverse movement by a quick-acting lever arrangement.

The ends of the rigidly constructed base are extended outward

Fig. 2. Colonial Universal Broach-sharpening Machine Set up for Sharpening Long, Small-diameter Broach

To obtain additional information on equipment described on this page, see lower part of page 176.

to provide a full-length support for the work-table, which is 99 inches long by 11 1/2 inches wide. The table travels on one flat and one V-shaped way, the ends being provided with dust guards. Lubrication of the table is maintained by rollers submerged in oil wells. The grinding wheel head is mounted on a vertical column attached to the bed of the machine with replaceable V-gibs. The maximum amount of travel is 12 inches.

A cross-slide mounted above the graduated indexing support at the top of the vertical column provides a 10-inch travel of the grinding wheel spindle crosswise of the work-table. The wheel-spindle is mounted on preloaded precision ball bearings, and is belt-driven by a 3/4-H.P. motor having a speed of 3600 R.P.M. Interchangeable pulleys provide various spindle speeds up to approximately 7500 R.P.M.

Two handwheels provide three movements of the wheel-head and work-table. Rotation of the handwheel on the right moves the table to the right and left under the wheel-head. The left-hand wheel has two positions, "In" and "Out." In the "In" position, rotation of the wheel controls the horizontal feed of the slide and the wheel-head. In the "Out" position, the handwheel controls the vertical movement of the wheel-head. The shift from the "In" to the "Out" position is quickly made by depressing a small lever behind the handwheel. A quick-action lever provides a rapid traverse action for the horizontal slide

For cylindrical broach sharpening, the headstock is provided with a 1/3-H.P. motor and reduction gearing which gives spindle speeds of 200 and 400 R.P.M. The speed change is accomplished by a lever in the headstock housing. The tailstock is equipped with a spring-loaded quick-release lever. For this type of sharpening the left handwheel is placed in the "In" position.

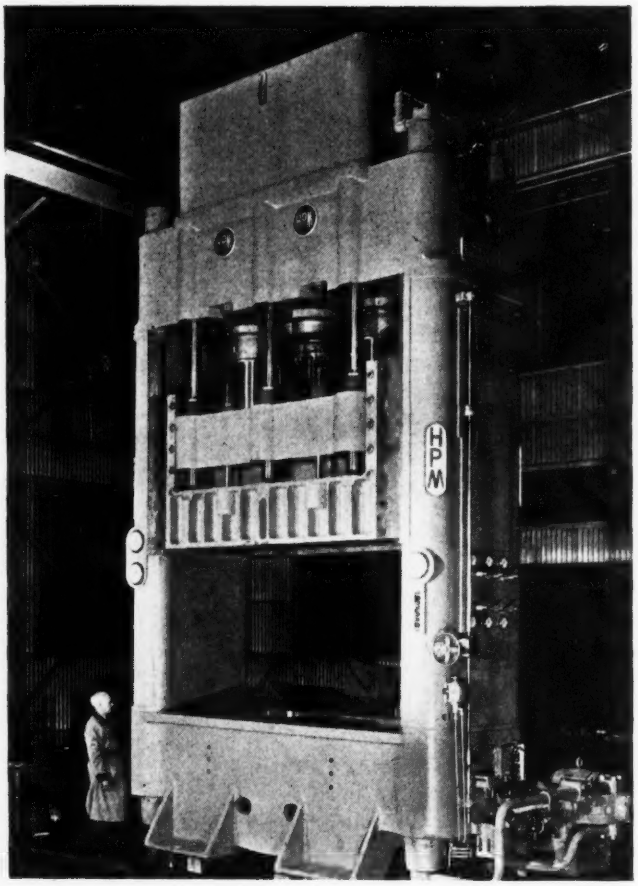
The barrel type steadyrests furnished with each machine are of rigid construction with contact points made from round fiber to prevent injury to the broach. Quick-acting lock-screws provide for rapid location and adjustment of the steadyrests. The fiber contact points are readily inserted and adjusted in the steadyrests to accommodate work of various diameters. The spindle, motor, and cross-slide assembly can be rotated on the vertical column in a horizontal plane to obtain the desired grinding wheel cutting angle.

The wheel-head gear-box and other internal parts are packed with lubricant to eliminate need for frequent attention. The machine requires a space of about 20 by 4 feet, including maximum table travel, and weighs approximately 6800 pounds. 51

Hydraulic Presses for Producing Aircraft Parts

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has developed a self-contained H-P-M Fastraverse deep-drawing press for sheet metal, equipped with blank-holder and die cushion for drawing large, deep metal airplane parts from aluminum alloy, steel, and other sheet metals. A ring carried by the blank-holder slide holds the work while the part is being drawn. Usually the part is drawn completely from a flat blank in a single stroke of the press. The press will accommodate all standard types of deep drawing dies or, if required, can be employed for single-action press work, such as coining, sizing, straightening, etc.

The blank-holder slide is operated in tandem with the main slide and suspended from the latter member. The two slides advance together at identical speed until they come in contact with the blank. The hollow press bed is fitted with an H-P-M hydraulic die cushion, which can be used as an ejector when desired. Pressure is variable at six points on the periphery of the blank-holder ring. This is an advantage when drawing parts of irregular contours, where the blank must be held more securely at certain points and be permitted to slip at other points.



H-P-M Fastraverse Deep-drawing Press for Aircraft Work

The press employs the H-P-M closed circuit operating system, in which reversal is accomplished by reversing the output of the radial pump. Since this system requires no operating valve, reversal is shockless. Means are provided to operate the press in any one of three different ways, that is, manually, semi-automatically, or as a fully automatic machine. Electric push-button controls are provided.

The pressure capacity of the main slide is 750 tons, and of the blank-holder slide 300 tons. The die-cushion

To obtain additional information on equipment described on this page, see lower part of page 176.

platen has a capacity of 125 tons. Pressing surfaces of the main slide measure 105 by 38 inches, and of the blank-holder 120 by 60 inches. The die-cushion platen is 90 by 40 inches. The maximum daylight opening between the main slide and bed is 114 inches, and between the blank-holder slide and bed 96 inches.

The maximum travel of the main slide is 42 inches, and of the blank-holder slide 27 inches. The die-cushion platen has a maximum travel of 10 inches. The ram closing speed is 205 inches per minute; the pressing speed is 110 inches per minute under a pressure of 250 tons, and 36 inches per minute under a pressure of 750 tons. The opening speed is at the rate of 205 inches per minute. The complete machine weighs approximately 231,000 pounds. 52

Greenfield Tool and Cutter Grinder

The Production Machine Co., Greenfield, Mass., has recently added to its line of Greenfield tool and cutter grinders a No. 4 grinder, which can also be supplied as a universal machine with cylindrical and internal grinding attachments.

Various attachments are available for use on this machine which adapt it for handling practically any grinding operation within its capacity. The sleeve of the elevating handwheel is graduated to 0.001 inch. The spindle bearings can be adjusted to compensate for wear and 'to take up end play. Sight-feed oilers insure proper lubrication. Screw adjustment is provided for use in grinding accurate straight and taper work. One graduation on the taper-setting scale represents a taper of 1/8 inch to the foot.

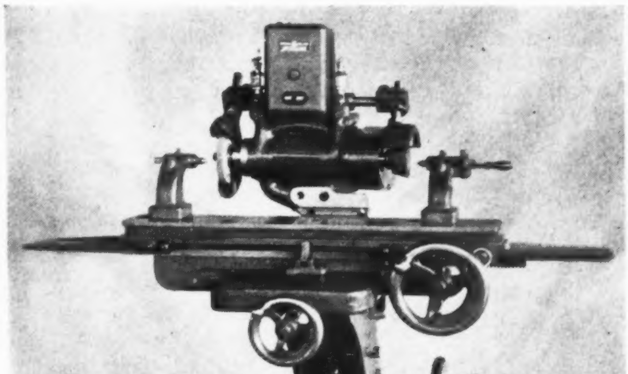
The cylindrical grinding attachment consists of a 1/20-H.P. motor connected by V-belt to a spindle on which a suitable drive is mounted. This attachment will handle work up to 3 inches in diameter by 12 inches long.

The internal grinding attachment consists of a head attachment like the one used for cylindrical grinding, except that the driver and centers are removed and replaced by a 4-inch universal chuck. The internal grinding attachment has a 1/2-H.P. motor. The main spindle has a speed range of 3600 to 4025 R.P.M., while the internal spindle has a speed of 13,000 R.P.M. The machine weighs 794 pounds. 53

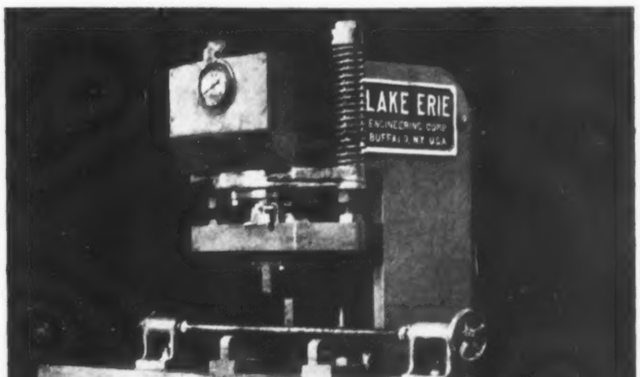
Lake Erie Shaft-Straightening Press

A sensitive, quick-acting, shaft-straightening press, complete with anvils and centers for testing, is announced by the Lake Erie Engineering Corporation, Buffalo, N. Y. The pumping unit, of 20-ton capacity, is self-contained in the base of the press. The ram operates at high speed, and is equipped with quick-return springs.

Combination hand-lever and foot-pedal control is so arranged that either can be used independently. Maximum down stroke of the ram can be quickly adjusted by a control on the chuck. The pressure control handle is conveniently mounted on the front of the main pedestal. The main frame is built up of cold-rolled steel side plates, electrically welded to form one solid, rigid unit. 54



Greenfield Plain Tool and Cutter Grinder, Also Made as a Universal Machine



Sensitive Shaft-straightening Press Built by Lake Erie Engineering Corporation

To obtain additional information on equipment described on this page, see lower part of page 176.

Fig. 1. Loading and Unloading Bomb-cleaning Machine

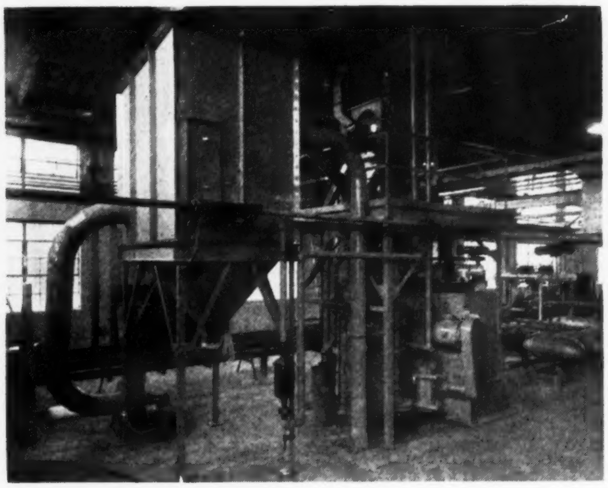


Fig. 2. Side View of Bomb-cleaning Machine Shown in Fig. 1

Automatic Bomb-Cleaning Machine Developed by the Pangborn Corporation

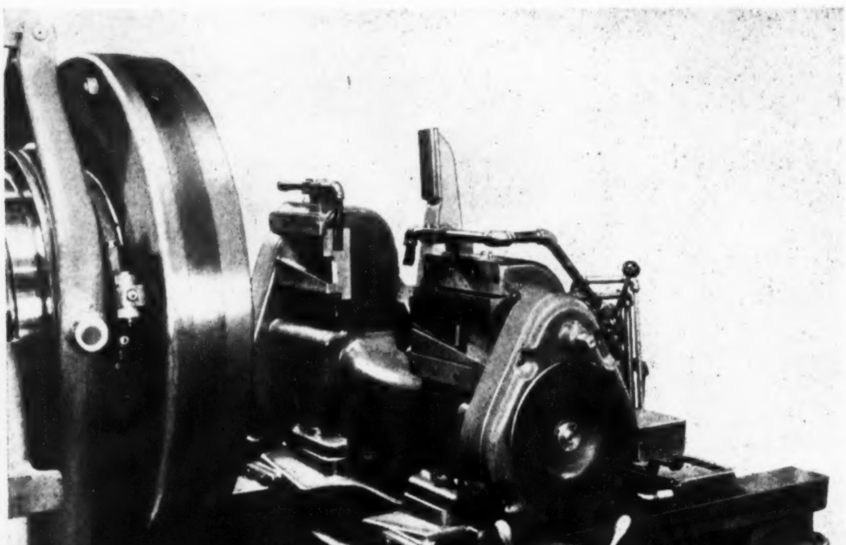
As bombs and aerial torpedoes constantly grow larger in size and weight, more efficient equipment must be provided for cleaning their metal casings of scale and dirt to facilitate inspection. The detection of flaws that might affect the efficiency of a bomb can be accomplished more satisfactorily directly after blast cleaning than at any other time. A special machine designed to perform this cleaning operation thoroughly and quickly has been developed by the Pangborn Corporation, Hagerstown, Md.

Fig. 1 shows how bombs are loaded on and unloaded from the special indexing hooks that carry them suspended from the top into the cleaning section of the cabinet, where a battery of Rotoblast units cleans the outside surface uniformly, while an Airblast nozzle inserted within the bomb casing thoroughly cleans the interior surface.

The Rotoblast units, the blast tanks that supply the nozzle operating from a pit below the floor level, and the Pangborn dust collector which provides ventilation for the entire operation and keeps the atmosphere surrounding the equipment free from dust are shown in the side view, Fig. 2. 55

Landis Hydraulically Controlled Cutting-Off Unit

The Landis Machine Co., Waynesboro, Pa., has recently developed a hydraulically controlled cutting-off unit designed to replace the standard carriage, cross-rail, and die-head of Landis mill type pipe-threading machines in cases where these machines are to be used exclusively for cutting-off operations and maximum operating efficiency is desired. The cutting-off device comprises two high-speed steel cutting-off tools, mounted in slides built for maximum rigidity. The tool-slides function through a hydraulic cycle which provides rapid traverse of the tools to the work and rapid retraction after the cutting-off operation is completed. A single lever controls both the forward and return movements of the tool-slide.



Cutting-off Unit Applied to Landis Mill Type Pipe-threading Machine

The complete operator control of the hydraulic cycle provides variable feed rates for the cutting-off tools and adjustment of the length of travel of these tools for different thicknesses of tubing. Adjustment for rate of feed is made through a single control valve, so that both the front and rear cutting-off tools will have the same feeding rate. The cutting-off tool-slides likewise are adjustable within certain limits for various sizes of tubing. 56

To obtain additional information on equipment described on this page, see lower part of page 176.

Fig. 1. Hilco Universal Cutter-grinder Set up for Sharpening a Helical Milling Cutter

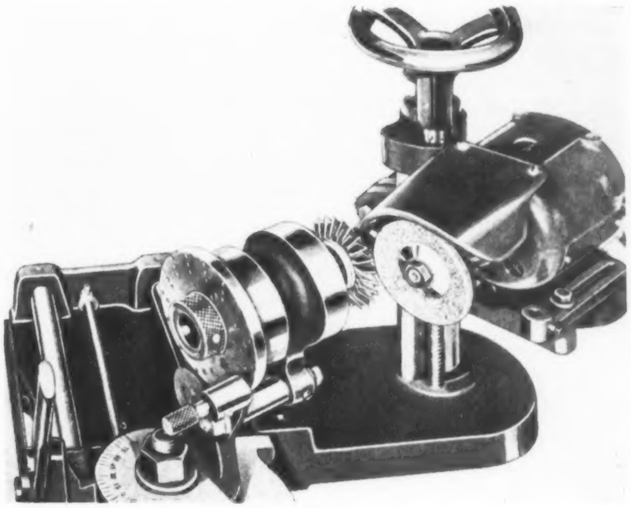


Fig. 2. Cutter Grinder with Index Dividing Head, Set up for Sharpening Double Angular Cutter

Hilco Universal Cutter-Grinder with Special Index Dividing Head

A high degree of flexibility, quick set-ups, accommodation of a wide range of cutters, compactness, absence of vibration, and sturdy construction are features of the new Hilco universal cutter-grinder brought out by the Berco Mfg. Co., 429 W. Superior St., Chicago, Ill.

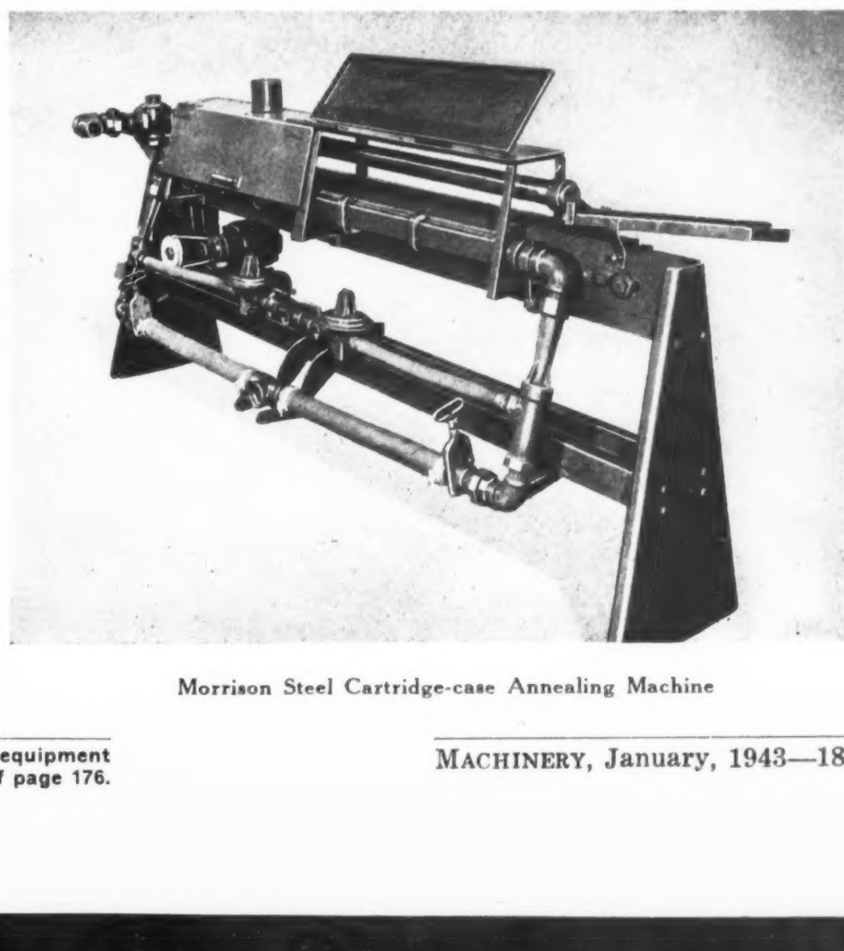
This grinder is shown in Fig. 1 equipped with an interchangeable table or flat-bed attachment, as set up for sharpening a helical milling cutter. Fig. 2 shows the machine provided with a special universal index dividing head for sharpening a double angular cutter. Regardless of the type of tool being ground, the machine can be set up in a few minutes for any other type of cutter. It will grind any concave, convex, helical, straight, tapered, angle, or special cutter up to 6 inches in diameter, and any saw up to 18 inches in diameter, regardless of the cutting angle.

The dividing head has seven index circles consisting of micrometer-located holes or stops, which insure uniformity of cutting edges in the finished cutter, regardless of the number of teeth or cutting surfaces. Grinding set-ups can be made quickly for any type cutter requiring simple or compound angle, horizontal, diagonal, or vertical, direct or reverse position setting.

This grinder is of the bench type and occupies little space, being only 21 inches long, 17 inches deep, and 17 inches high. It weighs approximately 135 pounds. The new grinder is especially adapted for tool-cribs in large plants where attendants spend their spare time in sharpening all types of cutters. It is equally useful in smaller shops where the individual workman grinds the tools he is using to suit the job handled. 57

Morrison Annealing Machines for Steel Cartridge Cases

A line of flame type, mouth and taper annealing machines for steel cartridge cases up to 105-millimeter and larger has been brought out by the Morrison Engineering Corporation, Cleveland, Ohio. These machines are designed to quickly and economically produce a uniform anneal at and near the mouth of the cartridge case so as to facilitate the tapering and crimping operations. Two general types of machines are available, one accommodating up to 20-millimeter cartridge cases, while the other handles all the larger sizes of cartridge cases.



Morrison Steel Cartridge-case Annealing Machine

To obtain additional information on equipment described on this page, see lower part of page 176.

The machine for the small size cases is a straight-line type, while the larger machine is of the modified dial design. The flame type and taper annealing machines are gas-fired and have continuous conveyors. In the larger machine, a conveyor chain carries rotating work-spindles provided with fixtures suited to the size of the cartridge cases being annealed. When desired, spindles can be furnished with different sizes of fixtures to permit the handling of cases of different but not too widely divergent sizes.

The cases rotate as they pass along the front of the frame. Burners are of the blast line type, with adjustments to provide compensation for various gases and operating conditions. All controls, including proportional mixers and zero governors, are supplied to provide for a heating section and a holding or heat-soaking section.

Burner equipment can be supplied with height adjustment when cases of different sizes are to be annealed in one machine. Loading and unloading is a continuous manual operation at one end of the machine. A sheet-metal hood with vent connection encloses the operating mechanism. Hinged sides permit easy burner adjustment. Approximate production speeds are 4800 pieces per hour for the smallest sizes and 400 pieces per hour for the largest, or 3-inch, cases. 58

Lindberg Forced-Convection Heat-Treating Furnace

A new type of forced-convection heat-treating furnace with a heating capacity up to 1750 degrees F. has been developed by the Lindberg Engineering Co., 2444 W. Hubbard St., Chicago, Ill. This furnace is claimed to have made possible a definite speed-up in hardening, annealing, normalizing, tempering, nitriding, and other heating operations, with an accompanying saving in floor space and labor. The new unit, designated the "Super Cyclone," is said to have increased production in some instances from three to twelve times. The forced-convection heating arrangement is designed to permit the handling of work on fixtures or in work baskets rather than by spreading it out on the hearth.

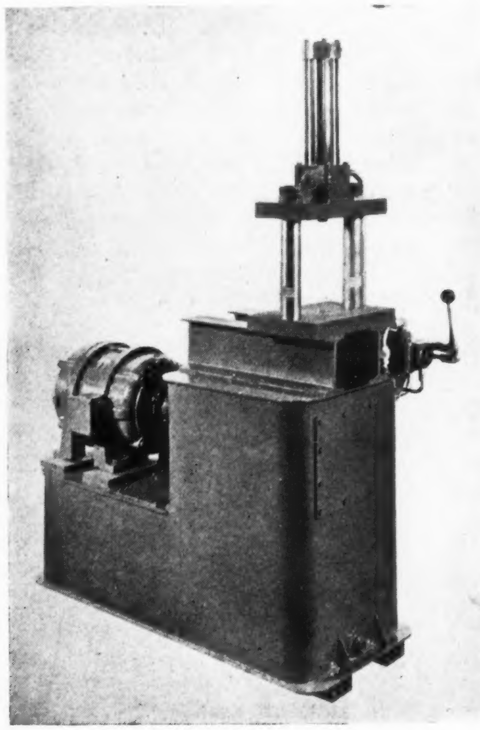
The heat is forced under pressure by a high-velocity fan through every part of the charge. This completely eliminates radiation to the work from a source that is hotter than the desired work temperature, and thus does away with one-sided heating. 59

Hydraulic Arbor Press

A hydraulic arbor press with a rated capacity of 6 tons and a maximum stroke of 8 inches has just been placed on the market by Hydraulic Machinery, Inc., 10421 Grand River, Detroit, Mich. This press has a daylight space of 20 inches, and an opening from left to right of 20 inches. The power unit, reinforced on the top by two I-beams, acts as the base for the press assembly. A lever-operated valve determines the direction and the speed of the closing movement, which can be adjusted to 3.4 inches per minute.

The press platen is 34 inches from the floor, and the over-all height is 75 inches. The arbor press and power unit combined occupy a floor space of only 24 by 42 inches. The motor is direct-connected, and is rated as 5 H.P. at 1200 R.P.M. It operates on three-phase, 60-cycle alternating-current circuit. The motor is equipped with a manually operated four-way valve which is self-centering. The gage has a registering range of from 0 to 2000 pounds pressure. 60

Lindberg Fuel-fired "Super Cyclone" Furnace for Normalizing or Hardening Steel Castings



Hydraulically Operated Arbor Press Built by Hydraulic Machinery, Inc.

To obtain additional information on equipment described on this page, see lower part of page 176.

Wilson Alternating-Current Welding Machine

An alternating-current transformer type welding machine designed to combine greater safety with improved operating efficiency has been added to the line of the Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York City. The most interesting feature of this alternating-current welder, known as the "Bumble Bee," is its low open-circuit current of 42 volts, which is automatically and positively maintained by means of equipment recently developed by the engineering department.

Two primary coils are used instead of one, a magnetic connector being incorporated in one primary. Each primary contributes approximately 42 volts to the total open-circuit voltage, which is, therefore, actually 84 to 85 volts. However, when the machine is idle, one primary is automatically cut out, reducing the open-circuit current to 42 volts. As soon as the electrode contacts the work, the second primary is thrown into the circuit to furnish the full voltage.

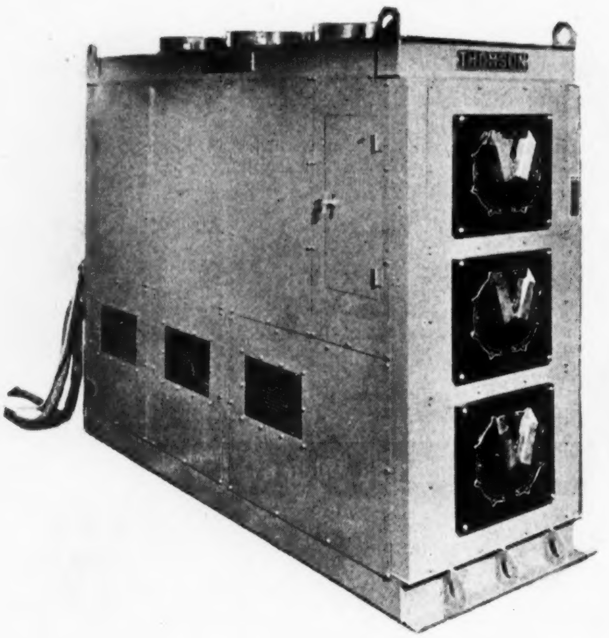
Wilson Welding Machine with Automatic Current Control

The welder has dual voltage connections for either 220 or 440 volts, and thermal overload protection. A single handwheel control provides stepless current adjustment throughout the NEMA range. 61

Thomson "Power Pack" for Resistance Welding

The Thomson-Gibb Electric Welding Co., Lynn, Mass., has developed new resistance welding equipment known as the "Power Pack," which comprises a compact, self-contained unit connected by flexible cables to one or several welding guns or other type welders. A feature of this equipment is its ability to provide from a three-phase alternating-current power source ample direct current for making one or several spot or projection welds at any point within 150 feet of the Power Pack. A much higher power factor and better balanced loading are advantages claimed for this equipment.

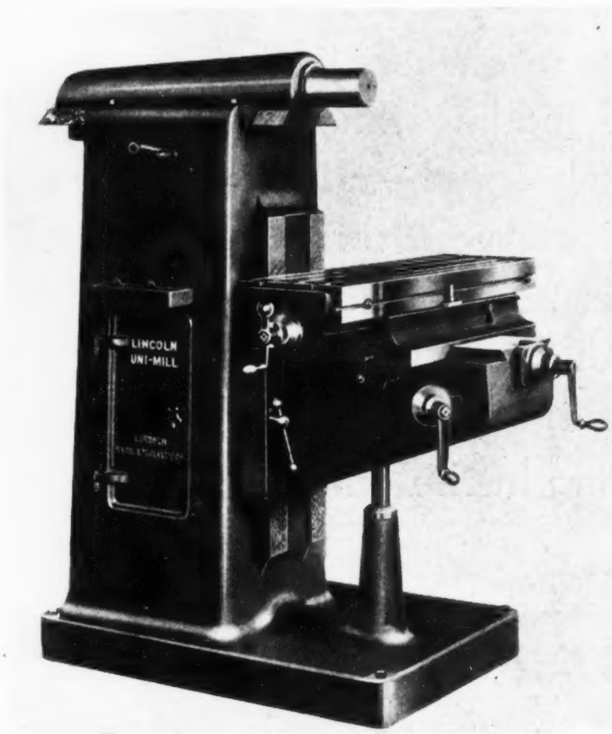
The Power Pack houses a three-phase transformer and a three-phase copper-oxide rectifier with connecting bus-bars, air blowers for individual cooling of each unit, ignitron type contactors, timing control, and voltage regulators. It is capable of furnishing current for welding aluminum up to 0.040 inch thick and stainless steel or mild steel up to 0.064 inch. 62



"Power Pack" Welding Equipment, which Provides Direct Current from an Alternating Current Source

Heavy-Duty Machine Designed to Use High-Speed Milling Head

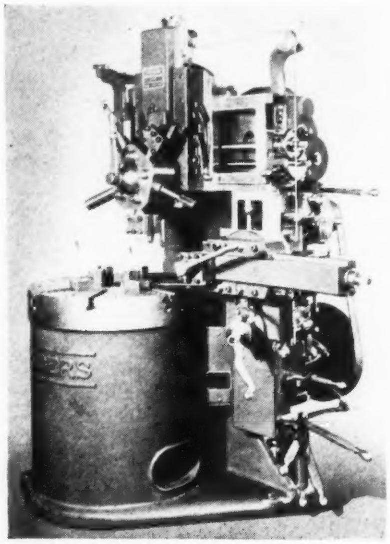
The machine here illustrated is designed to accommodate any make of high-speed milling head. It is supplied either with or without a detachable head by the Lincoln Machine Specialty Co., 549 W. Washington St., Chicago, Ill. The new machine, designated the "Uni-Mill," is built to handle heavy-duty



Lincoln Machine Specialty Co.'s Heavy-duty Machine Designed to Use High-speed Milling Head

To obtain additional information on equipment described on this page, see lower part of page 176.

high-precision work, thereby releasing power-driven milling equipment for other essential work. It has a table 10 by 42 inches, and will take cuts up to 30 inches in length. Ample stability for heavy precision work is assured by its 2300-pound weight. 63



Rogers Special High-speed Vertical Turret Mill

Oster Automatic Indexing "Rapiduction" Turret Lathe

The No. 601 "Rapiduction" turret lathe made by the Oster Mfg. Co., 2073 E. 61st St., Cleveland, Ohio, is now being equipped for automatic indexing. The machine has a capacity for cutting off, boring, tapping, reaming, facing, threading, and many other operations on round work up to 1 1/2 inches in diameter. The new lathe can be used to release more costly machines and highly skilled operators from work on a wide range of bar and chucking jobs. It is also suited for rapid training of new operators.

For use where three or less than three operations are required in sequence, the machine can be furnished with a plain saddle instead of the six-station turret. The machine is also available with a worm or direct drive to the spindle, a two-speed motor, reverse, and electric brake control. The motor drive is by means of multiple V-belts, speed changes being obtained by quick-change sheaves. The lathe can be equipped to furnish four spindle speed ranges from 70 to 500 up to 900 to 3000 R.P.M. A belt-connected coolant pump is assembled in the base of the machine. A floor space of 33 by 70 inches is required for the machine itself, not counting the bar feed extension, which requires an extra 94 inches. 64

Lyon Hydraulic Elevating Type Welding Positioner

The welding positioner recently brought out by the Lyon-Raymond Corporation, 1106 Madison St., Greene, N. Y., has a hydraulically operated tilting and elevating table. The table can be revolved to any position mechanically by means of a worm-gear arrangement. The table is 30 inches in diameter, and has T-slots for 5/8-inch bolts. The lowered height of the table when in the horizontal position is 28 inches, and the elevated height 40 inches. With the table in the vertical position, the lowered height of its center is 22 inches, and the elevated height 34 inches. The table can be tilted to any angle from the horizontal to the vertical position.

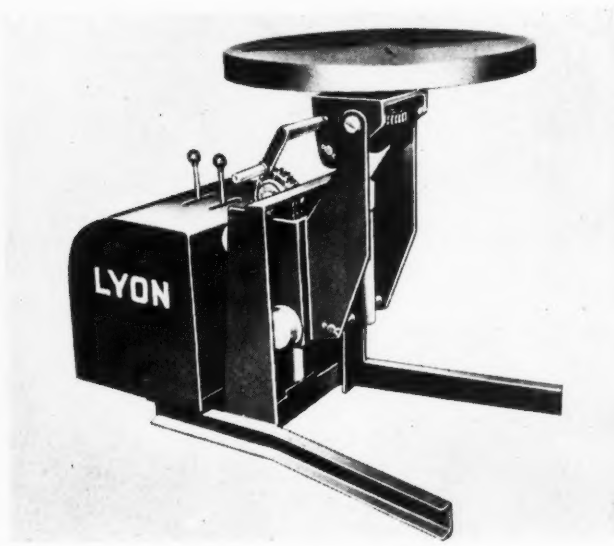
The hydraulic pump is driven by a 1/2-H.P. motor, which can be operated on a 110-volt, 60-cycle, single-phase, alternating-current lighting circuit. The capacity of this positioner is 2000 pounds. 65

Vertical Turret Mill

A special high-speed vertical turret mill has recently been added to the line of the Rogers Machine Works, Inc., with sales office at 125 Arthur St., Buffalo, N. Y. This machine is designed for boring, drilling, and turning non-ferrous castings and forgings in aircraft and similar industries.

The main drive sheave of the new model runs at 760 R.P.M., which is double the speed of the standard Rogers vertical turret mill. Both models, however, have the same working capacity, being adapted for handling work up to 36 inches in diameter. 66

"Rapiduction" Turret Lathe Equipped for Automatic Indexing



Welding Positioner Manufactured by the Lyon-Raymond Corporation

To obtain additional information on equipment described on this page, see lower part of page 176.


METAL DRILLING MACHINERY
SUPER SERVICE
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3' or 4' ARM with 9" COL.
RADIAL
BULLETIN R-21-B
JIG BORER
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Productivity, Capacity, Adaptability, Reliability, Accuracy, Convenience and Economy are the intangible components that give the Cincinnati Bickford line of drills the appropriate name of SUPER SERVICE.
Examine the possibilities of the machines shown here and for further information send for any or all of the bulletins pertaining to the machines that interest you.
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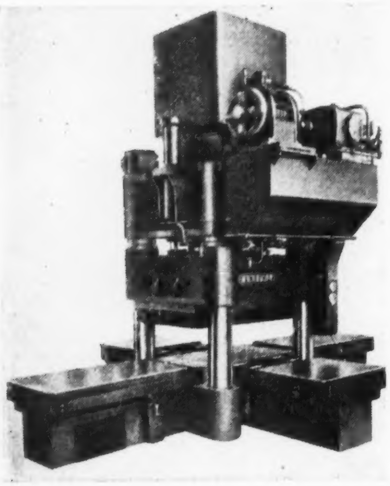
21", 24", & 28" ROUND and BOX COL. UPRIGHTS
BULLETIN U-25
THE CINCINNATI BICKFORD TOOL CO.
METAL DRILLING MACHINERY



Birdsboro Four-station Hydraulic Press for Airplane Work

Four-Station Hydraulic Press for Airplane Parts

A new hydraulic, rubber-pad type press adapted for the production of airplane parts has been announced to the industry by the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. The most outstanding feature of this press is the provision of four separate loading platforms designed to permit uninterrupted flow of aircraft parts.

Tables can be provided in varying lengths to suit long and short work. Loading and pressing operations are fully synchronized, and are automatically controlled to reduce operator fatigue. The press is equipped with adequate safety devices. Starting and stopping shock is eliminated through automatic speed control, which prevents the work from shifting during an operation.

The table and press movements can be stopped instantly by operators from any side of the press. The moving platen cannot drop suddenly when the power is interrupted. Full manual control is available to facilitate set-up, try-out, and special work requirements. 67

Lombard Milling Machine for Horizontal and Vertical Precision Work

The Lombard Governor Corporation, 700 Main St., Ashland, Mass., has developed a medium size milling machine for both horizontal and vertical precision work. Speed, versatility, precision and easy operation are the outstanding features of this new machine, designated the Lombard "30HV." It is sold either as a horizontal, vertical, or universal machine.

The universal type machine is shown in Fig. 1 set up for a vertical milling operation on bar work held in a vise. With this arrangement, a high-speed powerful drive is achieved through direct gearing and double-pulley V-belts. The hinged vertical head is swung into the position shown from the right-hand side of the machine. The actual change-over from horizontal to vertical milling can be accomplished in a few minutes.

The tapered shank of the vertical head fits into the horizontal spindle and is held by a draw-bolt. Clamping bolts hold the vertical head securely to the column. The control wheel at the top of the vertical head facilitates set-up, and its micrometer graduations provide means for quick depth adjustments for precision milling.

The knee-selector bracket is an important feature of the new machine. In Fig. 2, the operator is shown selecting the cross-traverse with his left hand, setting it either for power, hand or rapid traverse, while with his right hand he selects the direction of travel. The lever on the right of the control box is already set for vertical or horizontal position. The two starting buttons control horizontal, cross, and vertical travel. The button at the right controls the motion to the right and upward, while the button at the left controls the motion to the left and downward. The single-clamp rigid arbor support firmly braces the double over-arm, tying it to the knee. The lever under the arbor support in front of table sets the table either for feed or rapid traverse.

The table is equipped with power rapid traverse, which feeds at the rate of 100 inches per minute in

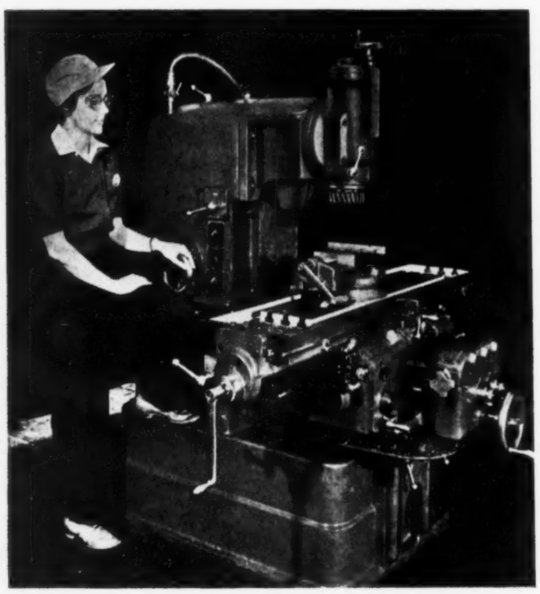


Fig. 1. Lombard Universal Milling Machine Set up for Vertical Milling Operation

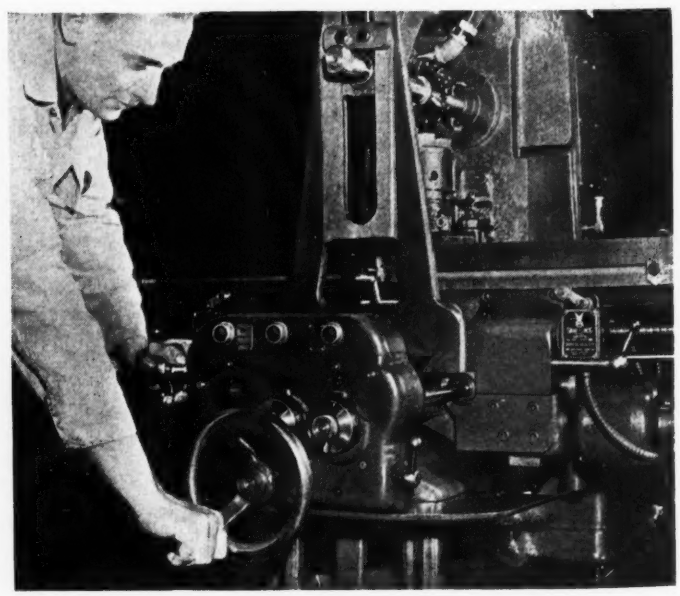


Fig. 2. Universal Milling Machine Shown in Fig. 1 Set up for Horizontal Milling Work

To obtain additional information on equipment described on this page, see lower part of page 176.

"It's an EX-CELL-O

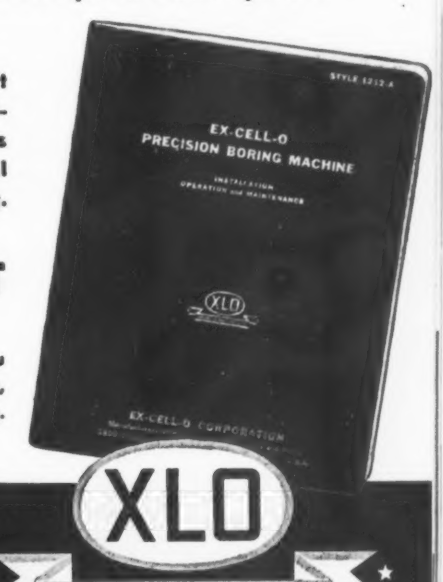
... PRECISION WORK IS A 'CINCH' ON THIS MACHINE!"

YES, all *EX-CELL-O* machine tools do *precision* work . . . they are purposely designed and built that way. As a matter of fact, it's now common practice throughout the metal-working field to use *EX-CELL-O* as another word for precision. Take the machine tool illustrated here. It's one of nine standard styles of *EX-CELL-O precision* boring machines, thousands of which are doing 24-hour duty in practically every type of American war industry. They are performing a wide variety of machining operations—boring, turning, facing, grooving, chamfering—where tolerances are extremely close and the highest production is essential. Their flexibility in use, their compact construction, their smooth and easily-controlled operation, their great strength and extreme rigidity... all these standard features make every *EX-CELL-O Precision* Boring Machine a favorite with both operators and owners under today's strenuous production pace.

Over each of the four plants of Ex-Cell-O in Detroit fly three flags . . . the Stars and Stripes, as always, the Army-Navy "E" pennant, and the first U.S. Treasury "Bull's-Eye" War Bond flag.

NOTE—If you are using one or more of your Ex-Cell-O Precision Boring Machines for short runs, need quick change-overs, or an all-round standard fixture, check into the added flexibility and time-saving advantages that an Ex-Cell-O Universal Fixture will give you. Work, fixtures and tools can be quickly, easily and rigidly mounted in any desired position on the vertical slide of this fixture and the slide may be set at any desired angle for boring, turning, or facing.

EX-CELL-O CORPORATION • DETROIT



To get best use of your Ex-Cell-O precision boring equipment, you should have the Ex-Cell-O Instruction Book. If you do not have it, write for free copy. State style of Ex-Cell-O machine you are using.

Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PRECISION PARTS

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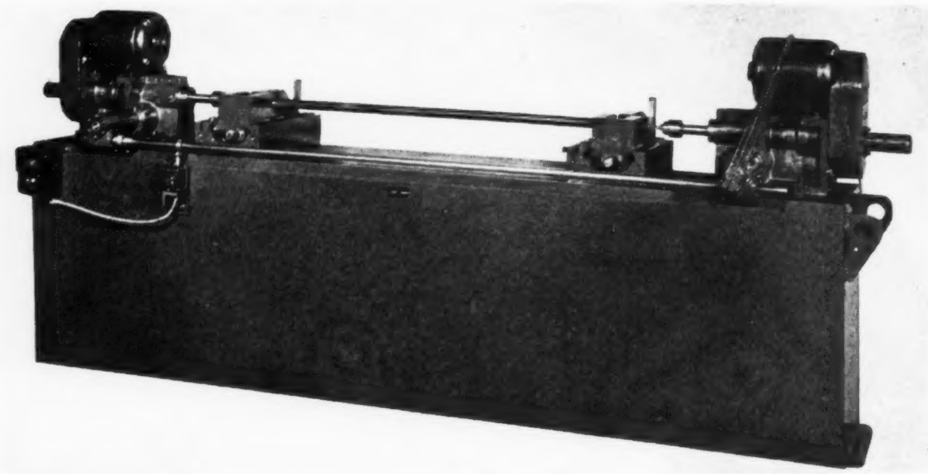
EX-CELL-O *means* PRECISION

both longitudinal directions, 50 inches per minute on cross-travel, and 25 inches per minute vertically. A skip-stop operation is provided for the automatic table cycle, as well as automatic spindle and coolant starting and stopping. Selection of the entire automatic cycle is easily accomplished. Dial-equipped controls regulate the speed, which ranges from 30 to 1900 R.P.M. or from 45 to 2850 R.P.M. Eighteen quick-change feeds, giving a 40-to-1 ratio, are supplied in geometric progression and can be conveniently changed within a range of 3/8 inch to 15 inches up to 1 inch to 40 inches per minute. 68



Two-spindle Automatic Centering Machine Built by Pines Engineering Co.

"HydroLectric" Motorized Hand-Lift Trucks

"HydroLectric" motorized, hand-lift trucks having rear-wheel drive and automotive gear transmission, and provided with excess motor and battery power, are built by Lift Trucks, Inc., Cincinnati, Ohio. These trucks handled average loads of 5000 pounds continuously for twenty to twenty-four hours in a fourteen-day test, compared with a 3000-pound load in an eight-hour day, for which the truck was originally designed.

Advantages claimed for these hydro-electric trucks include a powerful motor, large-size battery, and finger-tip control. 69

Pines Automatic Centering Machine

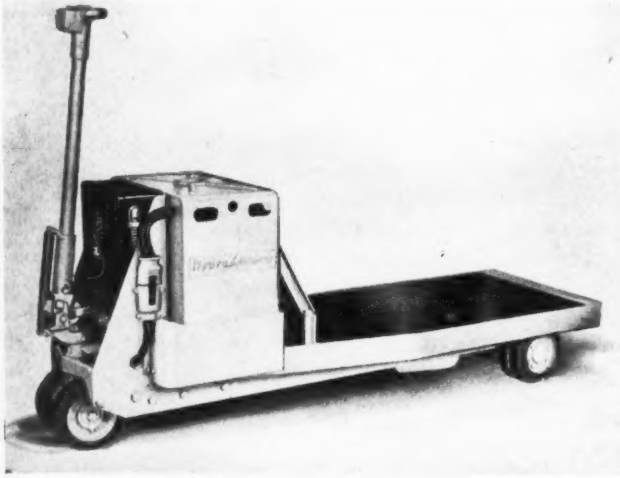
The Pines Engineering Co., Aurora, Ill., has placed on the market a two-spindle automatic centering machine with a capacity for handling bars up to 6 feet long. One chuck and one head of the machine are stationary, while the other chuck and head can be adjusted on the machine bed to accommodate bars of different lengths. One of the chucks is removed when centering pieces from 6 to 18 inches long.

The chucks are both actuated by air cylinders, directly connected through a rack and pinion on the screw provided for opening and closing the jaws. A cam on the shaft for advancing the two spindles actuates a four-way solenoid-operated air valve through a limit switch, which closes the chucks automatically. Adjustments are provided for aligning the chuck jaws with the spindles to compensate for wear. The chucks will accommodate round bars 5 inches in diameter. 70

Salsbury Turret Truck

A fully automatic clutch and self-shifting transmission are outstanding features of the Salsbury turret truck made by the Nutting Truck & Caster Co., Faribault, Minn. This power truck is available in lift, cargo, and tractor types. The engine is located over the drive-wheel, the complete driving assembly being contained within the turret. Steering is done by rotating the driving-wheel unit which provides extreme maneuverability.

The main frame of the power plant is mounted on ball bearings, and can be turned through a complete circle of 360 degrees for steer-



Hydro-electric Lift Truck Made by Lift Trucks, Inc.

Salsbury Turret Truck with Self-shifting Transmission

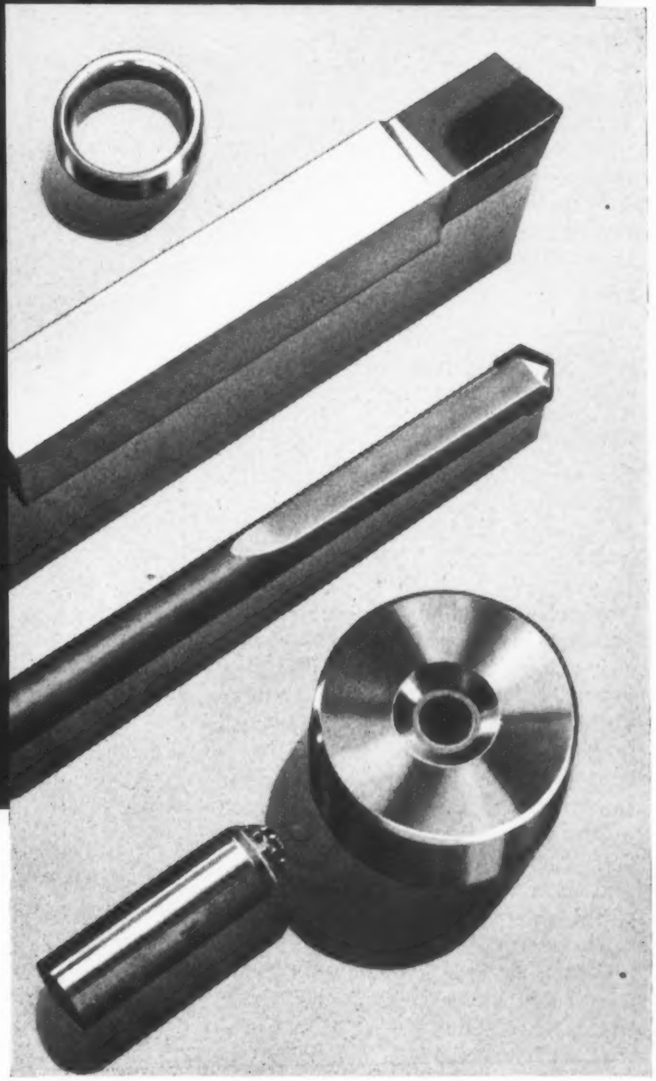
To obtain additional information on equipment described on this page, see lower part of page 176.

Use

All 5

Ways to STEP UP War Production . . .

With Carbides



1. Cut Metals Faster! . . . Carbide tools commonly double the volume of metal removed per hour. Cut wide range of material, from "tough" armor plate to "soft" plastics. Continuous or interrupted cuts. Adaptable to most old machines, as well as new. (Catalog GT-142.)

2. Dress Grinding Wheels Easier! . . . Diamond-Impregnated Carboloy dressers make diamonds do a full day's work every day! No time out for remounting. No lost diamonds. No "pampering" temperamental stones. Diamonds held permanently in place. Stocked in 3 sizes for wheels up to 42" diameter. (Catalog GT-142.)

3. Keep Machines Running! . . . Stop "shutdowns" caused by excessive wear on such parts as rollers, cams, guides, gages, valves, etc., used on your equipment. Just a small insert of carbide at the point of wear often increases life of parts up to 100 times longer. (Booklet WR-101.)

4. Draw Metals Better! . . . Draw, size, extrude your metals through carbide dies for better finish, greater accuracy, larger output, more continuous operation. Use for wire, bar, tubing, sheet metal. Outstanding for cartridge cases from .30 cal. through 105 mm. (Manual D-113.)

5. Install Equipment Quicker! . . . When installing new equipment, wiring and piping, or relocating present machines, carbide masonry drills drill holes 75% faster in concrete, brick, tile, porcelain, plaster. (Leaflet GT-103.)

CARBOLOY COMPANY, INC., 11147 E. 8 MILE BLVD., DETROIT, MICH.

(Sole makers of the Carboloy brand of cemented carbides)

Chicago · Cleveland · Los Angeles · Newark · Philadelphia · Pittsburgh · Seattle

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

CARBOLOY TRADEMARK **CEMENTED CARBIDES** TRADEMARK

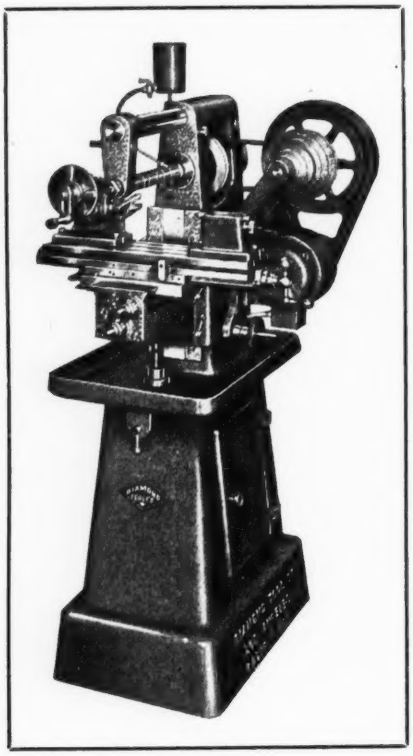
TOOLS · DIES · DRESSERS · CORE BITS · MASONRY DRILLS · WEAR RESISTANT PARTS

ing in any direction. To reverse the direction of travel, the operator simply turns the turret and drive-wheel through an angle of 180 degrees in one motion. The power turret is a completely independent unit, and can be easily removed for servicing. Power is furnished by a single-cylinder, four-cycle, air-cooled engine, which provides a maximum speed of 8 miles an hour under full loads. 71

Milling Machine for Small Work

The Diamond Tool Co., 3429 E. Olympic Blvd., Los Angeles, Calif., has brought out a milling machine of smaller size than the ones previously developed. The new machine is available in both tool-room and production models. Although much smaller in size than regular machines, and priced considerably lower, this machine provides the rigidity, accuracy, and capacity of larger machines. It has a precision high-speed needle bearing for the over-arm arbor support.

The vertical collapsible pulley arrangement has a safety device and motor lock for use in making speed changes. Anti-friction bearings, manually operated lubricating fittings, and a one-shot spider-web lubricating arrangement for the table, saddle, and knee are provided. The production model is equipped with a rack and pinion feed. The previous Model 24 and the new smaller Model 20 machines have accessories that can be readily interchanged. 72

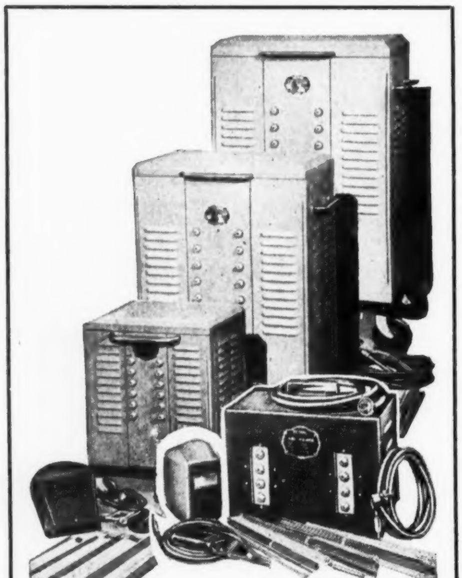


Diamond Milling Machine for Small Work

Heavy-Duty Portable Welder

Trindl Products Ltd., 2227 HW Calumet Ave., Chicago, Ill., is placing on the market a heavy-duty portable alternating-current arc-welder especially intended for use on a wide range of small production and maintenance jobs that cannot be handled economically on larger welders. Simplicity of operation and portability are the outstanding features of this Model 125 welder, which is shown in the lower right-hand corner of the accompanying illustration.

The comparatively light weight of 125 pounds permits this welder to be easily carried to the job, where it can be connected to any convenient electrical circuit. It is furnished with a vernier type control panel and sixteen welding-heat stages ranging from 10 to 125 amperes. The larger welders made by this company have been redesigned for heavier duty continuous operation and are now encased in rugged metal cabinets and mounted on casters. 73

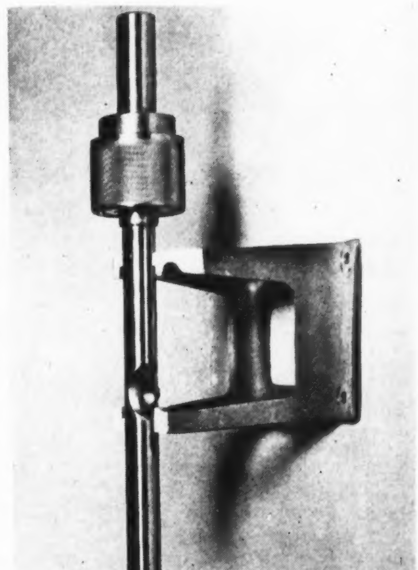


Trindl Improved Arc-welding Equipment

Burr-Removing Tool

A burring operation that formerly required fifteen to twenty minutes is now performed in forty-five seconds with the aid of a new burr-removing tool brought out by the Nobur Mfg. Co., 6156 Santa Monica Blvd., Los Angeles, Calif. The production requirements for one of southern California's large aircraft companies demanded that all aileron pulley brackets be completely free of burrs and sharp edges. This necessitated the use of small hooked hand-scrapers, which were inserted from the outer side to remove the burrs on the inner edges. The illustration shows how the job is done now with the Nobur tool.

This tool has a special blade ground for a two-step diameter, the outer face and inner shoulder of the ball-bearing seat being burred simultaneously. Twenty-five parts are now finished in the time formerly required to finish one part. A great improvement in the quality of the finished work, more uniformly smooth edges, and a great saving in time have resulted from the use of this tool. The tool is available in sizes ranging from 3/16 to 1 inch, varying by 1/16 inch. Special sizes and blades can be furnished. 74



Nobur Burr-removing Tool

To obtain additional information on equipment described on this page, see lower part of page 176.

NICK BARLOW'S DAUGHTER

may run this Hydraulic Lathe

MARY BARLOW is thoroughly feminine. Certainly, she would never work in a machine shop from choice. But she's ready to substitute for a man at the front if necessary. And it *may* be—soon.

She doesn't relish a complex job that involves a long apprenticeship. Give her work she can do right away—on a machine that's simple to operate; that requires very little training—a machine like the Gisholt Hydraulic Automatic Lathe where she merely loads and removes the work, and the machine does all the rest.

Because, once this war is over, she wants to go back to her woman's world.

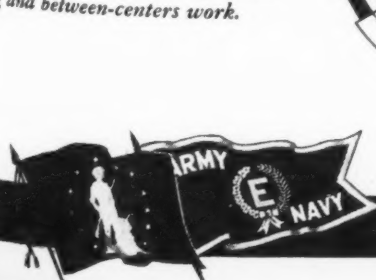
THE GISHOLT HYDRAULIC AUTOMATIC LATHE . . .

performs its swift cycle of machining operations automatically, maintaining accuracy at high cutting speeds. Extremely simple to operate, it handles a wide variety of chucking and between-centers work.

GISHOLT

GISHOLT MACHINE COMPANY
1209 **East Washington Ave., Madison, Wisconsin**

LOOK AHEAD . . . KEEP AHEAD . . . WITH GISHOLT IMPROVEMENTS IN METAL TURNING



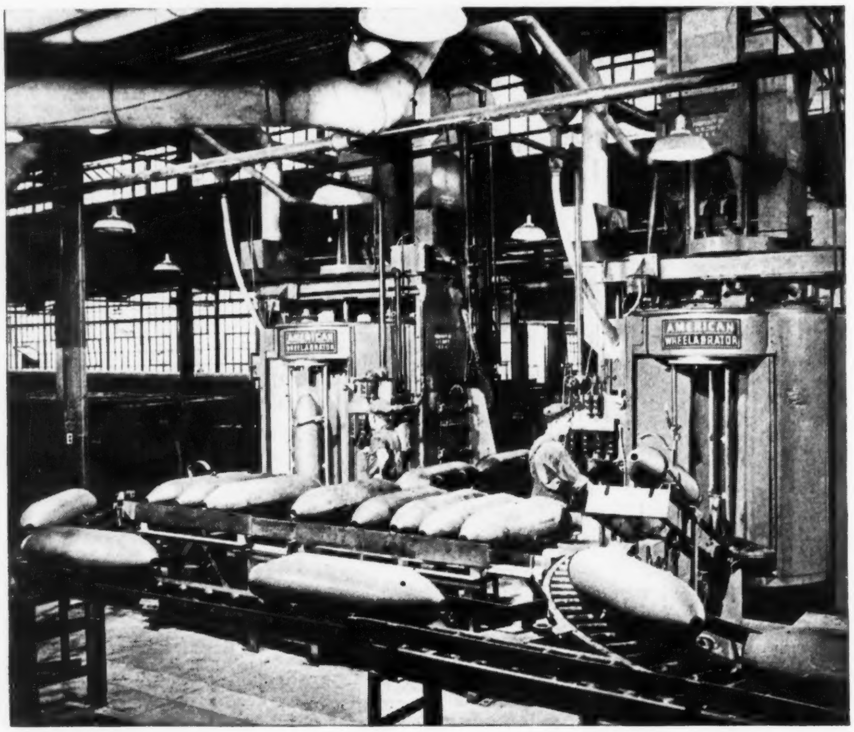
At Gisholt, the Army-Navy "E" and the Treasury Flag fly side by side

TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

American Wheelabrator Bomb-Cleaning Machines

American Wheelabrator bomb-cleaning machines, built by the American Foundry Equipment Co., Mishawaka, Ind., have recently been installed at an Indiana manufacturing plant for removing scale from 500-pound semi armor-piercing and demolition bombs prior to machining operations. Both the interior and exterior surfaces of the bombs are cleaned in the machines, an airless Wheelabrator unit being used for blast-cleaning the exterior, while compressed-air grit-blasting is employed after heat-treating to remove the scale from the interior of the large bombs.

These bomb-cleaning machines operate automatically. The bomb to be cleaned falls from the conveyor line into a loading device, which lifts it into a hanger at the front of the machine. As the bomb-laden hangers pass into the blasting chamber they are indexed and rotated over a lance type air-blast nozzle, which enters and thoroughly scours the interior of the bomb with steel abrasives. At another station, the bomb is rotated in front of an airless Wheelabrator unit, the blast of which completely covers the exterior of the bomb. As the cleaned bomb revolves to the front of the cabinet it is removed and another bomb put in its place. With only a few minor changes this type of machine can be adapted for cleaning a wide range of sizes and types of shells. 75



Bomb-cleaning Machines Built by the American Foundry Equipment Co.

Hill-Bartelt Thread Milling Machine

The Hill-Bartelt Machine Co., 229 S. Church St., Rockford, Ill., is introducing on the market two models of a newly designed thread milling machine, one model, shown in the accompanying illustration, is a single-purpose machine, while the other is a general-purpose machine with adjustable features that permit changing the set-up to accommodate a wide variety of work.

Hill-Bartelt Single-purpose Thread Milling Machine

These machines are fully motorized, and have all driving elements completely enclosed in a rigid structure. Electrical controls and the coolant system are also fully enclosed, but are easily accessible through doorways and plate openings. The machine requires a floor space of only 42 1/4 by 28 inches.

The single-purpose model can be made up for cutting either right-hand or left-hand external or internal threads with a multiple type thread mill. Feed is accomplished by means of a cam synchronized with the work-spindle. This cam governs the complete cycle, including rapid return and dwell for reloading. Work up to 3 inches in diameter is held in an air-operated collet chuck. Controls include start and stop buttons for the motors, a feed clutch release lever, and a chuck-operating handle.

The general-purpose model, having the same basic elements, will handle a wide range of work. The cutter-head has a tilting adjustment for aligning the cutter with the helix angle of the thread. Either single or multiple type cutters can be used. Two types of feed are available—either cam or lead-screw feed. The machine will cut threads from 5 to 32 pitch, up to 9 inches in length with a single cutter, and up to 2 inches in length with a multiple cutter. Cross-feed is provided for cutting pipe threads or taper threads. A tailstock mounted on V-ways is included to give additional support to the work. This model can be adapted for fully automatic thread milling. 76

Soweigh Radial Weighing Scale

Weighing equipment of a new type has been developed by the Soweigh Scale Co., Delavan, Ill. This scale, intended for shop and factory use, is available for service over a given floor area without permanently requiring a definite floor space; because of its construction it is called the "Radial" scale.

It can be furnished from stock

To obtain additional information on equipment described on this page, see lower part of page 176.

designs to enable the load hook to swing over a radius of 8 feet or less; scales with larger radii can be built to order. It is regularly operated on a monorail track, the usual support being a building column. Scales with capacities of 4000 and 6000 pounds are available. 77

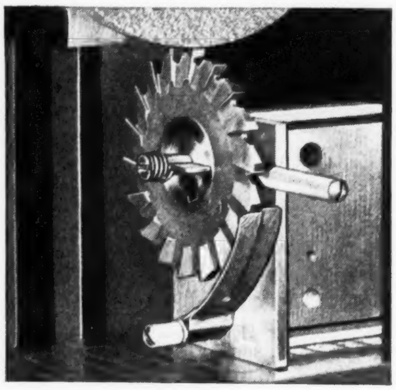
Furnace Designed for Low Power Operation

To assure efficient heat-treating under power supply conditions ordinarily considered inadequate for internally heated salt baths, the Upton Electric Furnace Division, 7450 Melville Ave., Detroit, Mich., has brought out an entirely new type of electric salt-bath furnace. This furnace is said to have shown improved heat distribution and produced heat-treated work of greater uniformity. Other advantages claimed for the new design are longer pot life and the impossibility of "shorting" and burning work through careless handling. When the power supply is inadequate to permit operating the furnace on one phase only of a three-phase power supply, three electrodes can be employed.

In this triangular-shaped furnace, the pot is bricked up, so that each electrode is located in a deep recess, thus eliminating the possibility of contact with the work. Two steel pots, one inside the other, and both insulated from each other and from the outside shell of the furnace, reduce heat loss. 78

Acro Grinding Fixture for Milling Cutters

The Acro Tool & Die Works, Department Z, 5324 N. Kedzie Ave., Chicago, Ill., has brought out a cutter grinding fixture known as the Acro "Kutrite." This fixture is designed to accurately position milling cutters, circular saws, gear-cutters, and many other cutters on the surface grinder, thus simplifying grinding operations that must ordinarily be performed by highly skilled men. With this new unit, any shop man can quickly learn to accurately grind the cutting edges of tools. One advantage of this fixture is that each sharpening operation is an exact duplicate of the others performed on the same or similar tools. Adjusting rods are provided to permit quick setting to the required angles. 79



"Kutrite" Grinding Fixture for Milling Cutters, Saws, Etc.

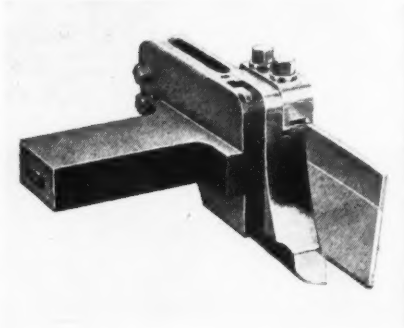
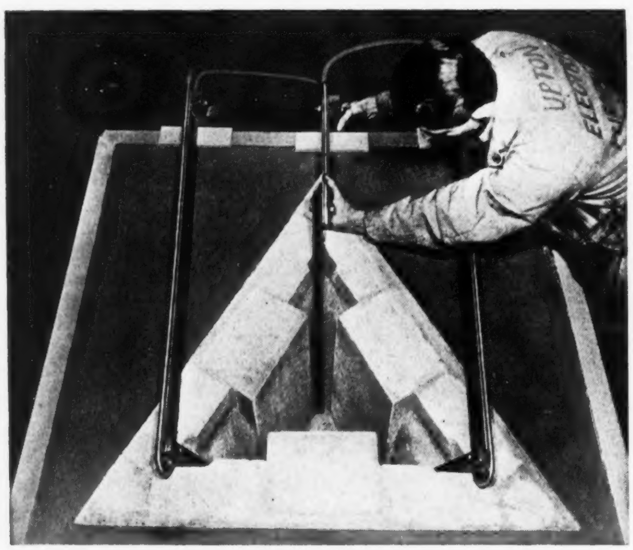


Fig. 1. Anthony Cutting-off Tool Made in Three Sizes for Work from 3 to 30 Inches in Diameter

Anthony Cutting-Off Tools

A complete line of cutting-off tools which includes an "E" series for engine lathes and a "T" series for turret lathes has been developed by the Anthony Tool Co., 233 Fredericksburg Road, San Antonio, Tex. The tools for cutting off small-diameter work are made without supporting blades, since the pivoting trunnion and "safety slip" design of the holders serves to prevent breakage of the blades.

The larger engine lathe tools, such as the No. E-16 shown in Fig. 1, are made in sizes for cutting off work from 3 to 30 inches in diameter. These tools have high-speed steel cutter blades supported by a blade of tempered tool steel, the supporting blade being arranged to provide the additional strength needed for cutting off work of large diameter. For light delicate work, blades only 1/16



Upton Triangular Type Electric Salt-bath Furnace Using Three Easily Removable Electrodes

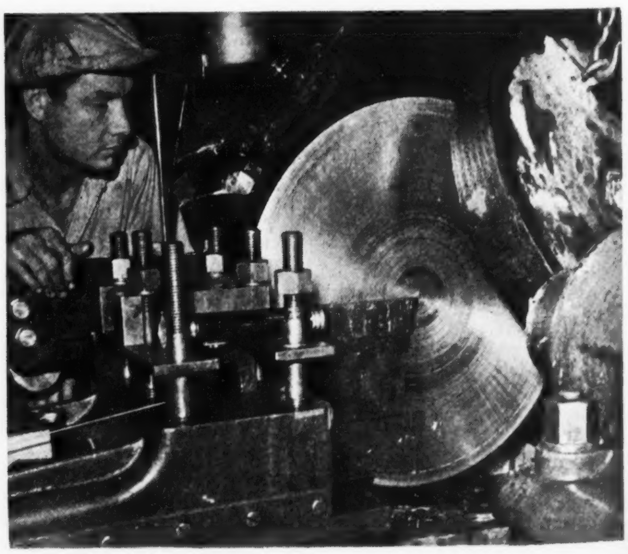


Fig. 2. Ship Propeller Shaft 27 Inches in Diameter Cut Off in Two Hours by Anthony E-30 Tool

To obtain additional information on equipment described on this page, see lower part of page 176.

inch thick are used, while for the heaviest work blades 7/16 inch thick are employed.

The "T" series cutting-off tools for turret lathes in the 3- and 4-inch models are made without the supporting blade, but it is used in the models for cutting off work from 4 to 12 inches in diameter.

The No. E-30 cutting-off tool, with a blade 7/16 inch thick, shown in Fig. 2, cut off the solid flange of a ship propeller shaft 27 inches in diameter in exactly two hours. The cutter was not reground during the operation, and the cut was straight within 1/32 inch. 80

Files for Naval Bronze

The Nicholson File Co., Providence, R. I., has brought out a line of files for use on Naval bronze, which is tough and much more difficult to file than ordinary brass or bronze. Because of its characteristics, very sharp files are required. Files used on castings of this metal must have strong teeth because of

Special-purpose File Brought out by Nicholson File Co.

the rough surface and other irregularities commonly found on such castings. Some castings require filing while still in a sanded condition, which results in an abrasive action on the file teeth.

The teeth of Nicholson files for Naval bronze are shaped so that they will not dig into the metal. This results in a good finish, and counteracts any tendency of the file to run off the work to one side. These files are available in all types and sizes in which regular-purpose files are made. 81

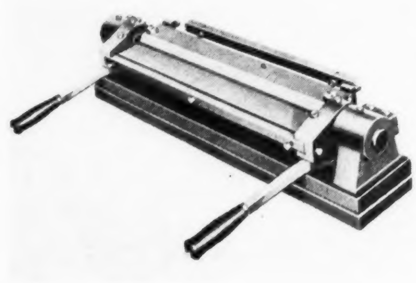


Fig. 1. "Di-Acro" No. 3 Bending Brake

Fig. 2. "Di-Acro" No. 2 Metal-cutting Shear

"Di-Acro" Shear and Bending Brake

New and larger models of the shears and bending brakes made by the O'Neil-Irwin Mfg. Co., 332 Eighth Ave. S., Minneapolis, Minn., are being added to this company's line of "Di-Acro" precision equipment designed for duplicating work ordinarily performed by dies.

The maximum folding width capacity of the new No. 3 brake, shown in Fig. 1, is 18 inches. Steel plate of 24 gage can be handled on this machine in widths up to 18 inches, while 18-gage steel plate can be folded in widths up to 12 inches. Heavier gages of narrower or more ductile materials can also be handled. This brake weighs approximately 200 pounds.

The No. 2 shear, shown in Fig. 2, is built to maintain a tolerance of 0.001 inch on all duplicated work. The maximum shearing width is 9 inches, and the maximum shearing capacity for this width is 22-gage steel plate. Both shear blades are of heavy tool steel, properly hardened, tempered, ground, and aligned. Adjustment is provided to compensate for wear and to obtain accurate control over the cutting action. A spring arrangement automatically returns the shear blade to the open position, ready for a new piece, after each cut is taken. This shear weighs about 40 pounds. 82

GS Tool Chest

The George Scherr Co., 128 Lafayette St., New York City, announces an addition to its line of GS tool chests, designated No. 1120. This is a new type toolmaker's chest, 20 by 9 1/4 by 16 3/4 inches. It has eleven drawers, including one drill drawer which can be used to hold either a drill block or a machinist's handbook. 83

Dillon Tensile Tester

A portable, Model B, table type tensile testing machine has been developed by W. C. Dillon & Co., 5410 W. Harrison St., Chicago, Ill., to meet the demands for a small tester of comparatively large capacity, both as regards testing pressure and specimen space. It can be used for testing any material within limits of 0 to 10,000 pounds, in sizes up to a foot in length and of proportionate width.

This tester will readily determine elasticity limit, stress, strain, stiffness, plasticity, resilience, material strength, etc., on the dynamometer indicator within limits of plus or minus 2 per cent. The maximum breaking point of the material is indicated by a red hand on the dynamometer.

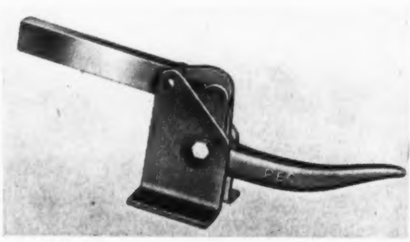
Dillon Portable Tensile Tester

To obtain additional information on equipment described on this page, see lower part of page 176.

The tester is 32 inches high, and has a base width of 19 inches and a distance between platens of 18 inches. The maximum jaw opening is 13 inches, and the weight 83 pounds. The base depth is 12 inches, and the width between posts 9 inches. 84

Self-Adjusting Jig Clamps

A new line of self-adjusting jig clamps that can be locked in any angular position up to 15 degrees above or below the horizontal setting is being manufactured by the Products Engineering Corporation, 700 E. Florence Ave., Los Angeles, Calif. They are sold under the trade name "Pec." These self-



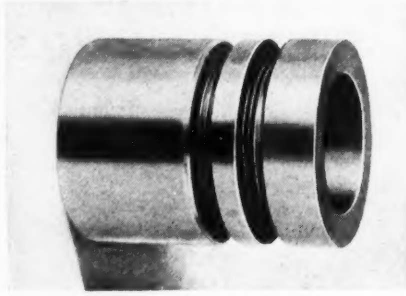
Self-adjusting Jig Clamp Made by Products Engineering Corporation

adjusting clamps make it possible to cover a large range of clamping requirements with a comparatively small number of clamps, since one "Pec" clamp will do the work of several ordinary clamps. Besides the self-adjusting feature, the clamps have a positive lock, are quick-acting, and are of drop-forged construction. 85

Spacer for Straddle Milling Cutters

A straddle milling cutter spacer designed to save set-up time has been introduced to the trade by the David J. Ross Co., 104 Ross Park, Benton Harbor, Mich. This equipment, known as the Rousselle "Victory Adjustable Spacer," was designed by Edward Rousselle to save, for actual production work, the time usually spent in grinding conventional spacers to size. With this spacer, it requires only a few minutes to reset straddle milling cutters after grinding.

The new spacer is simply slipped on the milling machine arbor to-



"Victory Adjustable Spacer" for Straddle Milling Cutters

gether with the conventional type spacers. The threaded collar of the spacer is then adjusted to give the correct cutter spacing or setting. The spacing attained in this manner is accurate within 0.001 inch. After the spacer has been set, it is locked in position by the inner locking ring. The total range of adjustment is approximately 1/2 inch. The spacer is made of alloy steel, hardened, ground, and accurately threaded. It is made in five standard arbor diameters of 1, 1 1/4, 1 1/2, 1 3/4, and 2 inches to meet requirements of all standard milling machines. 86

Duro Rotary Table

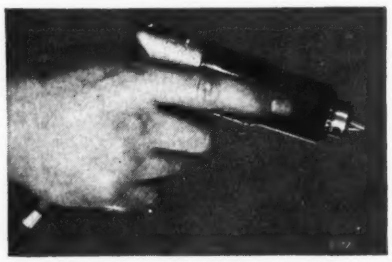
A 6-inch rotary table that can be used in places that are usually inaccessible is now being produced by the Duro Mfg. Co., 800 E. 61st St., Los Angeles, Calif. This rotary table has a worm-gear ratio of 60 to 1, which gives a 6-degree rotation for one turn of the crank and facilitates toolmaking, lay-out, inspection, and production work. Backlash is eliminated by an eccentric adjustment between the worm and gear.

Duro Small-size Rotary Table

The beveled dial is accurately cut and graduated to tenths of a degree. Two T-slots crossing at an angle of 90 degrees divide the table into four quadrants. A T-shaped lock-screw is provided for fixing the position of the table. The center hole in the table is 5/8 inch in diameter. All moving parts can be easily lubricated. The height is only 2 1/8 inches, and the weight 14 1/2 pounds. 87

Light-Weight Pneumatic Drill

A pneumatic drill identified as Size 00A, which weighs less than 2 pounds, is being manufactured



Ingersoll-Rand Light-weight Pneumatic Drill

by the Ingersoll-Rand Co., 11 Broadway, New York City. This drill has a "Multi-Vane" air motor, and is constructed to stand up under continuous operation. A built-in speed regulator is incorporated in the design, which can be set to meet performance requirements, and split-second throttle action permits of quick, accurate drilling. Lubrication is provided by a built-in automatic oiler. The chuck shield enables the operator to guide the drill accurately by grasping the shield with the fingers of his free hand. 88

* * *

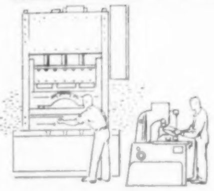
Lincoln Awards for Engineering Students

The James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio, announces an "Annual Engineering Undergraduate Award and Scholarship Program," in which $6750 is offered in awards and scholarships, the awards ranging from $25 to $1000; the scholarships are $250 each.

To obtain additional information on equipment described on this page, see lower part of page 176.

New STAMPING TRIMMERS

Stop Bottlenecks • Do the Impossible in War Production Plants



New, unusual, and complicated parts—required by new aircraft designs and other special war equipment —are being trimmed, formed, or both on Quickwork-Whiting Stamping Trimmers.

In many instances, these Quickwork machines have cut to seconds operations that were formerly done by slow, inaccurate methods.

If you have stampings of any kind—stainless, dural, or other alloy—or any shape, investigate Quickwork-Whiting Stamping Trimmers. By releasing presses and operators, and speeding up trimming or forming operations, they can break production bottlenecks in your plant.

The Quickwork-Whiting No. 8 Rotary Shear is widely used for trimming special stampings—in any plane—such as these aircraft parts. Clean, accurate edges are cut in a single pass.

Other Quickwork TIME SAVING Metal Working Machines

ROTARY SHEARS —available in a complete range of sizes to cut mild steel plate up to 1" thick. They also bevel, circle, flange, and joggle.

POWER HAMMERS —provide constant speed, unvarying rhythm. Force of blow controlled without slowing operation. Available in four sizes.

"QUICKWORK" WHITING

Division of Whiting Corporation, 15673 Lathrop Ave., Harvey, Illinois

New Army-Navy "E" Production Awards

The following companies in the machinery industries and allied fields have recently been added to the fast growing list of concerns honored for their achievements in the production of war equipment by the award of the Army-Navy "E":

Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

Henry Disston & Sons, Inc., Philadelphia, Pa.

Edwards Co., Division of Rogers Diesel & Aircraft Corporation, New York City.

Federal Products Corporation, Providence, R. I.

H. M. Harper Co., Chicago, Ill.

Jessop Steel Co., Washington, Pa.

Lempco Products, Maple Heights, Ohio.

Micromatic Hone Corporation, Detroit, Mich.

New Departure Division General Motors Corporation, Bristol, Conn.

Schauer Machine Co., Cincinnati, Ohio.

A. Schrader's Son, Inc., Brooklyn, N. Y.

Summerill Tubing Co., Bridgeport, Pa.

* * *

Long Service Records in Industry

In connection with the celebration of the forty-fifth anniversary of the founding of the Chambersburg Engineering Co., Chambersburg, Pa., the long service records of many of the employes of that company are of interest. There are twelve men who have been in the company's employ almost since it was founded, all of them having a service record of at least forty years. In addition, there are more than a dozen men who have been connected with the company for between thirty and forty years.

Motion Picture on Die-Casting

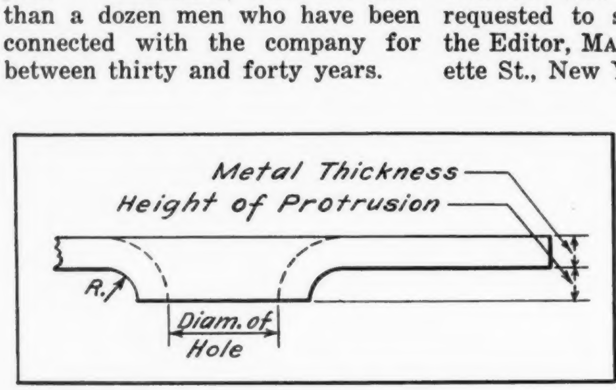
An exceptional industrial motion picture prepared for educational purposes is being placed at the disposal of educational institutions by the New Jersey Zinc Co., 160 Front St., New York City. This motion picture has been called "An Introduction to Die-Casting," and it amply deserves that title. In fact, it is more than an introduction—it is actually a treatise on the subject, beginning with the first principles of the die-casting machine and the mold, and from that point on calling attention to all the more important points that should be known by the engineer and man responsible for mechanical production in general.

The film has been specifically prepared with the idea of being educational and informative, explaining the production methods and the advantages of die-castings to students and engineers. While intended particularly for educational institutions, arrangements can be made with the New Jersey Zinc Co. to have the film shown to any group of interested engineers. A few very excellent films on industrial subjects have made their appearance recently. The present motion picture takes its place in the front rank of these films.

* * *

Information Requested on Protrusion

Information is wanted by a reader of MACHINERY on the subject of protrusion of sheet metal. Referring to the accompanying sketch, the relation between the metal thickness, the height of protrusion, the radius *R*, and the diameter of the hole is desired. Readers familiar with this method of production are requested to send information to the Editor, MACHINERY, 148 Lafayette St., New York City.



Sketch Showing Principal Dimensions of "Protruded" Work

Educational Posters to Prevent Tool Breakage

To help combat the great increase in tool breakage that has accompanied the introduction of untrained workers into the nation's war plants, the Genesee Tool Co., Fenton, Mich., has developed a series of educational posters designed to impress workers with the importance of proper tool handling and care.

Some of the posters dramatize, pictorially, the possible effect of tool breakage in delaying war production. Others bring home the value of the tools in terms of fighting equipment. Still others appeal to workers from the standpoint of danger to the continuity of their own jobs inherent in excessive tool breakage. In addition, some of the posters depict, in smaller insert illustrations, some common careless habits which frequently lead to tool breakage.

These posters, printed in three colors, and measuring 2 1/3 by 3 1/2 feet, are available without charge, primarily to users of the company's "Tomahawk" brand tools, for mounting beside tool-crib windows. A new poster will be furnished bi-monthly.

* * *

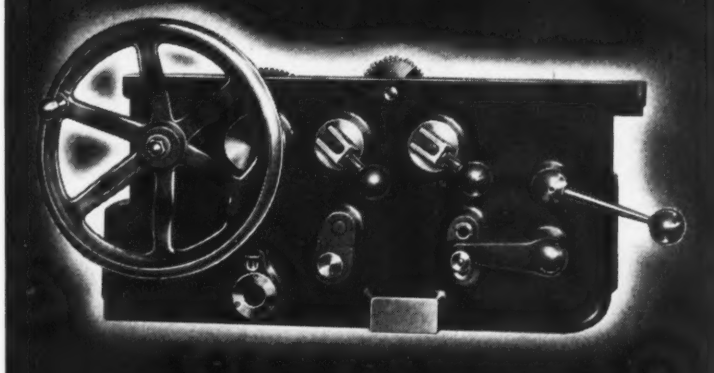
How Many Apprentices Remain with a Company?

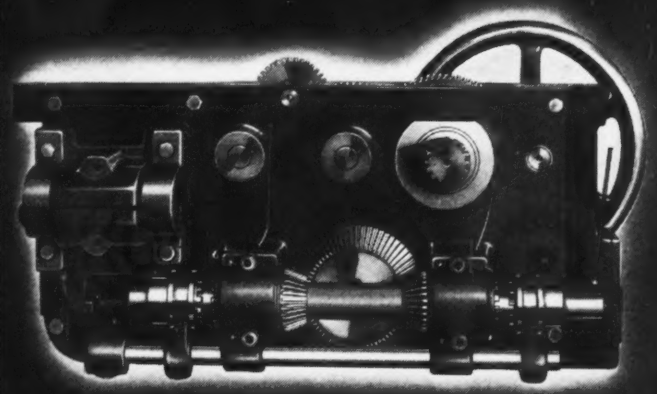
In speaking on "What Happens to the Apprentice Graduate," Ray E. Ellis, supervisor of apprentices at the General Electric Schenectady Works, said, before a meeting of the American Society of Mechanical Engineers, that out of the 2524 graduates of the Schenectady apprentice training course since it was started in 1901, 1400 are still with the company. Almost one-half of these have advanced to positions of responsibility in which they have charge of the planning and manufacture of a wide variety of products. The remaining half are skilled craftsmen, such as draftsmen, toolmakers, and machinists.

* * *

Before a man engaged in war work goes on strike, he ought to ask himself how he would feel if he were fighting seven days a week on the sands of Africa.

DOUBLE WALL APRON . . . ANOTHER STURDY FEATURE OF





Sidney Lathes

The Double Wall Apron is another point indicative of the modern design and sturdy construction of Sidney Lathes. This double wall Apron provides support to both ends of the heat treated shafts on which alloy steel gears are carried. Rack pinion and all shafts are anti-friction mounted. Snap levers actuating serrated tooth clutches control longitudinal and cross feeds. All controls are conveniently located for quick, easy operation.

Bulletins for this and other models immediately available

The SIDNEY MACHINE TOOL Company

SIDNEY **U.S.A.** **OHIO**

NEWS OF THE INDUSTRY

California

H. L. HARVILL Co. has been organized at 2223 E. 37th St., Los Angeles (Vernon), Calif., by H. L. Harvill, a pioneer in the field of aircraft die-castings. The new company will specialize in centrifugal castings, pressure castings and die-castings, as well as permanent molds. R. C. BECK is chief engineer of the company.

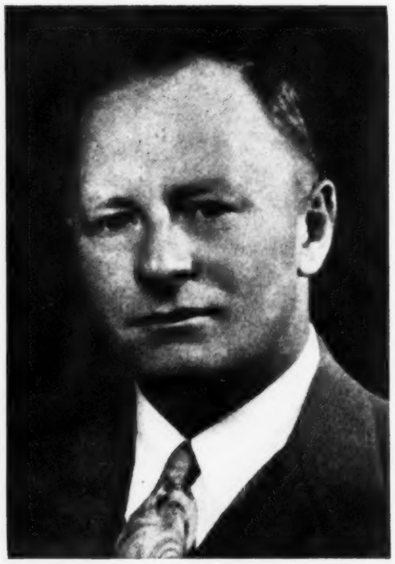
H. L. Harvill, Head of the Newly Organized Firm of H. L. Harvill Co.

Illinois

W. P. HOPKINS has been appointed purchasing agent of the Tuthill Pump Co., Chicago, Ill., manufacturer of rotary pumps and precision equipment for war and other industries. He was formerly assistant purchasing agent for the ordnance plant at Marion, O.

DAVID W. STOTTER has joined the advertising organization of MacFarland, Aveyard & Co., Chicago, Ill., as copy and account executive. For the last seven years, Mr. Stotter has been with Lord & Thomas, where he handled many national advertising programs.

JOHN H. SIPCHEN has been made first assistant to the president of the Anker-Holth Mfg. Co., Chicago, Ill. Mr. Sipchen will have charge of production and the development of air and hydraulically operated chucks, fixtures, and devices. He was formerly vice-president in charge of sales, engineering, and production for the Manufacturers' Equipment Co. of Chicago.



John H. Sipchen, First Assistant to President of Anker-Holth Mfg. Co.

WILLIAM C. CARTER, for fourteen years vice-president and for the past year executive vice-president of the Link-Belt Co., Chicago, Ill., has been elected president of that organization succeeding ALFRED KAUFFMANN, who has resigned because of ill health. Mr. Carter, a mechanical engineering graduate of the University of Illinois, became associated with the Link-Belt Pershing Road Chicago plant in 1902 as a draftsman. He has since held the positions of engineering department supervisor, construction superintendent, plant superintendent, plant general manager, vice-president in charge of production, and executive vice-president. Mr. Kauffmann, the retiring president, has served the company for forty-one years. He remains a member of the board of directors.

William C. Carter, New President of Link-Belt Co.

Michigan

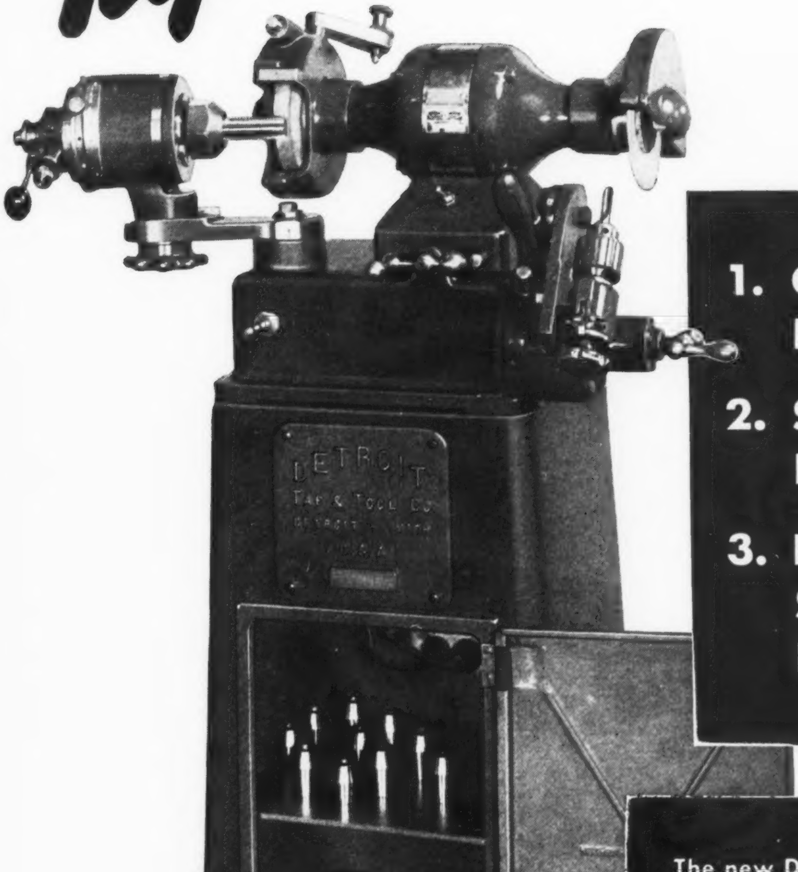
HARRY CRUMP, for the last twenty-six years associated with the General Electric Co., in Schenectady, N. Y., has joined the Carboloy Company, Inc., Detroit, Mich., as assistant to the sales manager, K. B. Beardslee. Since 1929, Mr. Crump has been development engineer on carbide tool applications and development at the central works laboratory in Schenectady. He was chairman of the Schenectady Chapter of the American Society of Tool Engineers, and has been active in training work in the Schenectady area since the inception of war, having taught classes in the machining of metals sponsored by the New York State and the Federal Governments.

Harry Crump, Assistant to Sales Manager of the Carboloy Company, Inc.

SEVERANCE TOOL INC., Saginaw, Mich., is a new corporation, formed to take over the operations of all the service branches of the Severance Tool Co. The plants that become part of the

THE NEW DETROIT

Tap Reconditioner



1. CHAMFERS R. & L. H. TAPS

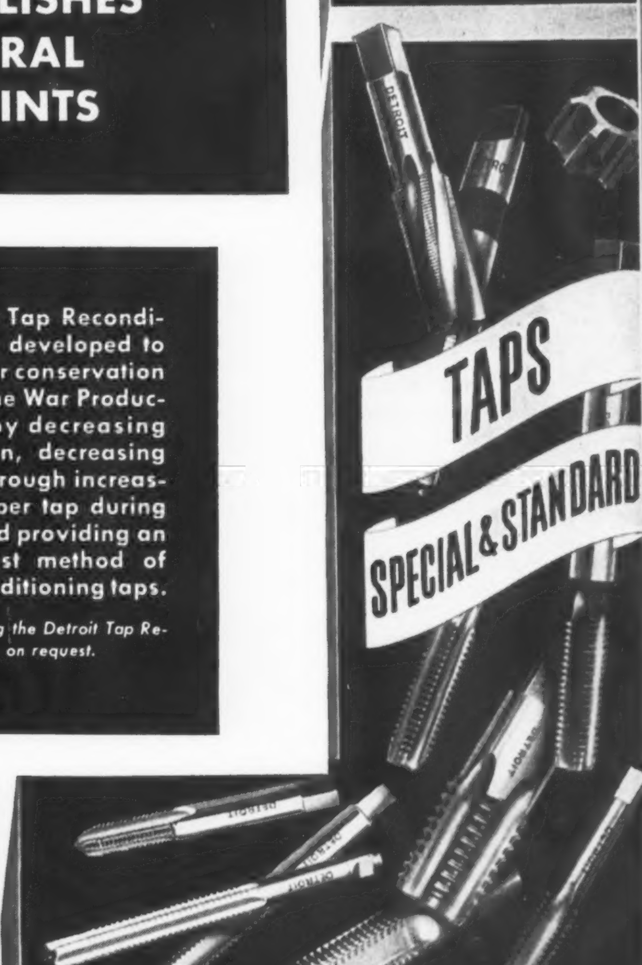
2. SPIRAL POINTS

3. POLISHES SPIRAL POINTS

The new Detroit Tap Reconditioner has been developed to meet the need for conservation of tools under the War Production Program by decreasing tap consumption, decreasing tapping costs through increasing the output per tap during its useful life and providing an efficient low-cost method of accurately reconditioning taps.

Bulletin TR-1, describing the Detroit Tap Reconditioner is available on request.

Write for your handy Wall Chart—"Recommended Angles for Reconditioning Taps".



DETROIT TAP & TOOL *Company* **8432 BUTLER DETROIT**

new corporation are located at Los Angeles, New York, Chicago, Detroit, and Fort Wayne; and a new plant is being opened at Springfield, Mo. The new corporation will have facilities in all its plants to handle regrinding, sales, and service operations on Midget milling cutters and other high-speed steel cutting tools designed by R. M. Severance. Mr. Severance is chairman of the board of the new corporation, and the other officers are: President, John A. Wright; vice-president and treasurer, George E. Hedberg; secretary, E. Elmer Staub.

WALTER E. GIBSON, formerly advertising manager of the Swartzbaugh Mfg. Co., Toledo, Ohio, has joined the advertising staff of Detroit Rex Products Co., Detroit, Mich.

New England

G. D. GILBERT, sales manager of the Baldwin-Duckworth Division of the Chain Belt Co., Springfield, Mass., has been made general manager of that division, and has also been elected secretary of the Chain Belt Co. to succeed A. R. ABELT who has become a vice-president. Mr. Gilbert became associated with the Duckworth Chain & Mfg. Co. in 1918, and was made sales manager in 1924. He is also a director of the Chain Belt Co.

L. S. STARRETT Co., Athol, Mass., recently dedicated a new building for the making of precision tools. The dedication ceremony was attended by 1800 Starrett workers. The new building is about 500 feet long by 70 feet wide, adjoining the original buildings. It has been constructed with the minimum of scarce materials, using heavy wooden trusses instead of steel.

DR. WALTER R. MEYER has been appointed technical director of the Enthone Co., 442 Elm St., New Haven, Conn. He will direct the development of new products and processes for the metal-finishing industry, as well as assist in problems connected with the application of the company's products in finishing war goods.

RUSSELL & ERWIN MFG. Co., New Britain, Conn., has been presented with the Maritime Commission "M" pennant for the speed with which it has met the requirements of the Maritime Commission shipbuilding program.

New Jersey

EARL S. PATCH has been appointed mechanical engineer in charge of application engineering by Henry L. Crowley & Co., West Orange, N. J., makers of high-frequency powdered iron cores and other powdered metal and ceramic materials. Mr. Patch was formerly sales manager of the Moraine Products Division of the General Motors Corporation.

W. F. McGUINNESS, secretary-treasurer of the Elastic Stop Nut Corporation, Union, N. J., has been made a vice-president of the company. He will also continue to fill the position of treasurer. Mr. McGuinness has been with the corporation since its inception in 1934.

WILLIAM H. KNIGHT has been appointed director of sales and market research for the Elastic Stop Nut Corporation, Union, N. J., manufacturer of self-locking nuts. Mr. Knight has had twenty years of experience in sales and marketing activities.

R. M. ELLIS has joined the Aircraft Parts Development Corporation, Summit, N. J., as chief mechanical engineer. Mr. Ellis brings to this post an experience of twenty years in research and product design.

New York

THE LINDE AIR PRODUCTS Co., 30 E. 42nd St., New York, has been awarded the Maritime Commission "M" pennant for the manufacture of flame cutting and welding equipment that has materially speeded up the shipbuilding program.

RALPH STRANG has recently been made head of the sales engineering department of the Morey Machinery Co., Inc., 410 Broome St., New York City. Previously he was chief of the Research Service Unit, Facilities Branch, of the War Production Board, and prior to that was European sales director for the Warner & Swasey Co., of Cleveland, Ohio, and the Gisholt Machine Co., of Madison, Wis.

Ralph Strang, Head of the Sales Engineering Department of Morey Machinery Co.

D. P. BRANNIN, who has been in charge of metal sales for the New Jersey Zinc Sales Co. in the Chicago area, has been appointed district sales manager of the Pigment and Metal Sales Divisions, with headquarters in Chicago. J. P. DUNPHY, of the New York sales department, has been made district sales manager of the Pigment Division, with headquarters in New York City. Mr. Brannin has been connected with the company for nearly thirty years, and Mr. Dunphy for almost twenty-five years.

CHARLES C. FICHTNER has been appointed vice-president and treasurer of the Strippit Corporation, North Tonawanda, N. Y., manufacturer of punching and notching equipment. Mr. Fichtner was previously with the United States Department of Commerce, Washington, D. C., where he served as Chief of Field Service and Chief of Division of Regional Economy.

ROY C. MOORE, of the Charles A. Schieren Co., New York City, has been elected president of the American Leather Belting Association; GEORGE L. ABBOTT, of the Graton & Knight Co., Worcester, Mass., has been elected vice-president; and ARTHUR H. RAHMANN, of George Rahmann & Co., New York City, treasurer.

R. E. ZIMMERMAN, vice-president of the United States Steel Corporation, has been re-elected president of the American Standards Association.

Pennsylvania and Ohio

CHARLES L. HUSTON, JR., director of personnel relations of the Lukens Steel Co., Coatesville, Pa., and a member of the board of directors, has been appointed assistant to the president of the company. Mr. Huston became connected with the Lukens Steel Co. in 1939, after serving ten years with the American Rolling Mill Co. of Middletown, Ohio. At the time he resigned to join the Lukens organization, has was assistant staff supervisor of employment and in charge of introductory training.

ALLEN GAGE & TOOL Co., 421 N. Braddock Ave., Pittsburgh, Pa., has added a thread grinding department for producing both standard thread plug and thread ring gages, as well as special gages and taps to customers' requirements. In addition, the company pro-

STRATEGIC

As a Direct Hit on An Aircraft Carrier

We have fixed our sights. Our entire set-up is revolutionized. Now we concentrate on Mounted Wheels and Vitrified Grinding Wheels 3" and under in diameter—24 hours a day, every day.

Our central location makes speedy deliveries certain.

- Wheels flow off our production lines and into your plant in a swift, steady stream. Speed assured on all orders. Count on us to meet bottleneck emergencies.
- Valuable man hours saved in your plant. There is no waiting for wheels.
- Customers—new wartime and old—get the same high quality that has been maintained since we introduced the first Mounted Wheels 45 years ago. We can take care of all your requirements for wheels 3" and under.

• • •

You should have our new catalog which illustrates in actual colors and sizes the largest line of Mounted Wheels made. Send for copy today.

CHICAGO WHEEL & MFG. CO.
1101 W. Monroe St., Dept. MR, Chicago, Ill.

Canadian Distributors:
Canadian Trade Corp., Ltd., 1332 Williams St., Montreal

MR-1
Please send copy of your new catalog.
Name
Address

duces a regular line of shell gages, steel mill and ordnance gages, and thread gages for tubular products.

C. A. Babbitt of the Norton Co., Worcester, Mass., has been appointed field engineer for the territory comprising New York City, New Jersey, and Philadelphia. He will make his headquarters at the Norton Philadelphia office.

Walter H. Gebhart has been appointed domestic sales manager of Henry Disston & Sons, Inc., Philadelphia, Pa. Mr. Gebhart has been with the company for thirty-three years, fifteen of which he has spent in the sales department.

J. O. Walz has been appointed assistant manager, and J. D. Miner manager of engineering in the Small Motor Division of the Westinghouse Electric & Mfg. Co., at Lima, Ohio. G. V. Bate has been made superintendent of the Sunbury, Pa., Works of the Westinghouse Electric & Mfg. Co., and E. G. Suiter has been appointed supervisor of production.

William James Russell, manager of engineering of the Appliance Division of the Westinghouse Electric & Mfg. Co., at Mansfield, Ohio, has been awarded the Westinghouse Order of Merit, given by the company's directors to employes of outstanding ability. The certificate of honor lists the achievements of the recipient. Mr. Russell was born in Scotland, in 1894. He fought four years in the last World War, being wounded twice and gassed three times. He came to the United States in 1920 and joined the Westinghouse organization in 1924.

A. H. B. Jeffords, management engineer for several years with the Trundle Engineering Co., Cleveland, Ohio, has been made a vice-president of the company. In 1917, Mr. Jeffords became general manager of the Standard Aircraft Corporation, Elizabeth, N. J. In 1920, he joined the Sherman Corporation, and four years later he became associated with the Trundle Engineering Co.

Wisconsin

A. R. Abelt, secretary of the Chain Belt Co., Milwaukee, Wis., has been elected a vice-president and a director of the company. Mr. Abelt became connected with the Chain Belt organization in 1907 as a young man, and has served in many capacities, including production, sales, and executive work. In 1922, he was made sales manager of the Chain Belt and Transmission Division, and early in 1942 he was made manager of that division.

R. E. McDonald has been appointed advertising manager of the Dumore Co., Racine, Wis., manufacturer of precision grinders and fractional horsepower motors. Mr. McDonald replaces R. B. Voelker, who is leaving to join the Armed Forces.

William M. Bloomer has been engaged as machine shop superintendent by the Brillion Iron Works, Inc., Brillion, Wis.

OBITUARIES

Clayton O. Smith

Clayton O. Smith, treasurer and general manager of the O. S. Walker Co., Inc., Worcester, Mass., manufacturer of magnetic chucks and small grinding machines, died suddenly of a heart attack on November 17 at his home in Worcester, aged seventy-two years. Although suffering from heart trouble for the last five years, Mr. Smith had been in comparatively good health and worked until his usual hour of leaving the office the day he died.

Mr. Smith was born on June 30, 1870, at Middlefield, Mass. He was educated in the elementary schools of that town, and received a bachelor of science degree in mechanical engineering in 1892 from the Worcester Polytechnic Institute, the following year being awarded a bachelor degree in electrical engineering. After graduating from college, he spent a year of study in the students' course of the Westinghouse Electric & Mfg. Co. at Pittsburgh. He then went to New Brighton, N. Y., where he worked a year for the C. W. Hunt Co.

Clayton O. Smith

Returning to Worcester in 1895, he was employed for five years by Norcross Bros., architects, and during his association with that company he helped design the South Station at Boston. In 1900, he became connected with the Norton Co., with whom he was associated until 1919, the last fifteen years in the capacity of sales manager.

Mr. Smith was active in church and civic affairs. He had been a member of the Lincoln Square Baptist Church for more than fifty years, and for many years served as treasurer, chairman of the finance committee, and trustee of the church. He was a former president of the Worcester Metal Trades Association and a member of the Rotary Club and the Worcester Economic Club.

He is survived by his widow, one son—Kenneth J. Smith of Worcester—and a sister—Mrs. L. L. Meacham of Cato, N. Y.

Adolph DeLeeuw

Adolph DeLeeuw, vice-president of the Goss & DeLeeuw Machine Co., New Britain, Conn., well-known engineer, designer, and inventor in the machine tool field, died at his home in Plainfield, N. J., at the age of eighty-one years. Mr. DeLeeuw was born in Holland in 1861. He attended the polytechnic school at Delft and the University of Leyden, where he obtained degrees in science and in mechanical and electrical engineering. He then became an instructor in mathematics, and before he was twenty-six years old he had written two text-books—one on algebra and one on geometry—at that time extensively used in his native country.

In 1890, he came to the United States and worked first for the Pennsylvania Railroad in its engineering department. A few years later he became chief engineer of the Niles Tool Works, Hamilton, Ohio, where he was among the first engineers to apply electric motors to machine tools. In 1910, he became associated with the Cincinnati Milling Machine Co. Here he designed a new type of cutter with widely spaced teeth.

In 1914, he was appointed chief engineer of the Singer Mfg. Co. In 1919, he opened his own office in New York as consulting engineer, specializing in plant management and production. He was retained by many of the leading companies in this country covering a wide variety of products, and obtained many patents. In 1923, he formed, with Stanley T. Goss, the Goss & DeLeeuw Machine Co., of New Britain, Conn., with which company he held the

position of vice-president and with which he was connected from that time until his death. Mr. DeLeeuw was a member of the American Society of Mechanical Engineers.

John J. Hebor

John J. Hebor, small tool and gage manager of the Cleveland office of Pratt & Whitney Division Niles-Bement-Pond Co., died on December 2. His passing is a real loss to industry, particularly in the Cleveland area, where his expert counsel was sought frequently to help solve production problems. He was widely known and leaves many friends.

John J. Hebor

Mr. Hebor was born in Meriden, Conn., January 30, 1892. He became connected with Pratt & Whitney in Hartford, Conn., in 1909 at the age of seventeen, and worked in the various departments of the Small Tool Division until 1915, when he was transferred to the Cleveland office. In a few years he rose to become manager of small tool and gage sales in that office, and has held that position ever since. He served Pratt & Whitney for thirty-three years, and wore the twin diamond thirty-year service button.

David S. Youngholm

David S. Youngholm, vice-president of the Westinghouse Electric & Mfg. Co. in charge of the company's Lamp Division, Bloomfield, N. J., died recently following a sudden heart attack. He was fifty-three years old.

During a career of more than thirty-three years with the Westinghouse organization, Mr. Youngholm became a nationally known authority and executive in the lighting industry. Under his direction the Westinghouse Lamp Division was converted to 95 per cent war production. Mr. Youngholm was born in New York in 1889. Immediately after leaving school in 1909, he joined the Westinghouse Lamp Co. in Bloomfield. In 1920, he was placed in charge of production, and in 1923, became assistant manager of sales. The following year he was made assistant general superintendent, and in 1930, he became assistant to the vice-president.

On October 28, 1936, three days before the reorganization of the Westinghouse Lamp Co. as the Lamp Division of the Westinghouse Electric & Mfg. Co., Mr. Youngholm was made vice-president of the latter company. In October, 1937, he was elected a director and vice-president of the Bryant Electric Co., Bridgeport, Conn. He also was elected a director of the Westinghouse Electric Supply Co.

Mr. Youngholm was awarded the Silver "W" Order of Merit in April, 1936, in recognition of "unusual foresight, energy, and tact in the management of the lamp company."

Charles A. Kropp

Charles A. Kropp, chairman of the board of the Kropp Forge Co. and the Kropp Forge Aviation Co., Chicago, Ill., passed away on Thursday morning, December 17, at his winter home in Miami Beach, Florida. He was seventy-seven years old.

Mr. Kropp was widely known in the steel industry and metal-working trades, having been identified with the forging industry all of his life. He organized one of Chicago's earliest job forging shops in 1901, known as the Sundberg-Kropp Co., the present extensive Kropp Forge Co. and subsidiaries having evolved from this nucleus.

Mr. Kropp was born at Annefors Bruk, Sweden, June 26, 1865, and migrated to the United States in the late '80's. The present Kropp Forge Co. had its roots in the water-powered forge shop founded by his father in 1837 at Annefors, Sweden, where the son learned his trade. Many proprietary methods, developed in this primitive Scandinavian shop, were brought to this country by Mr. Kropp.

In the span of his lifetime, Charles Kropp piloted the Kropp Forge Co. from a small shop with half a dozen employes to what is believed to be the largest job forging shop in the world, with over a thousand employes.

Mr. Kropp had been inactive the last few years, spending most of his time at his Florida and Round Lake, Ill., homes. He is survived by his wife and two sons Roy A. Kropp, president, and Raymond B. Kropp, treasurer of the Kropp Forge Co. and Kropp Forge Aviation Co.

COMING EVENTS

JANUARY 11-15—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary, 29 W. 39th St., New York.

JANUARY 14-15—MARKETING CONFERENCE of the AMERICAN MANAGEMENT ASSOCIATION at Hotel Drake, Chicago, Ill. For further information, address the Association, 330 W. 42nd St., New York City.

APRIL 28-30—WAR PRODUCTION CONGRESS and annual meeting of the AMERICAN FOUNDRYMEN'S ASSOCIATION in St. Louis, Mo.; headquarters, Hotels Jefferson and Statler. C. E. Hoyt, executive vice-president, 222 W. Adams St., Chicago, Ill.

* * *

Production Equipment Section of Sweet's Catalog Service

Sweet's Catalog Service announces the Production Equipment Section of Sweet's Catalog for 1942. This book comprises a file of manufacturers' catalogues compiled especially for the use of engineers and operating and maintenance officials of plants in the mechanical industries. It contains 820 pages and includes catalogues from 110 companies, covering machine tools, attachments, accessories, cutting tools, portable and hand tools, gaging equipment, pressing and forming equipment, welding equipment, marking equipment, and metal hardening and finishing equipment. A limited number of copies are available through Sweet's Catalog Service, 119 W. 40th St., New York City.

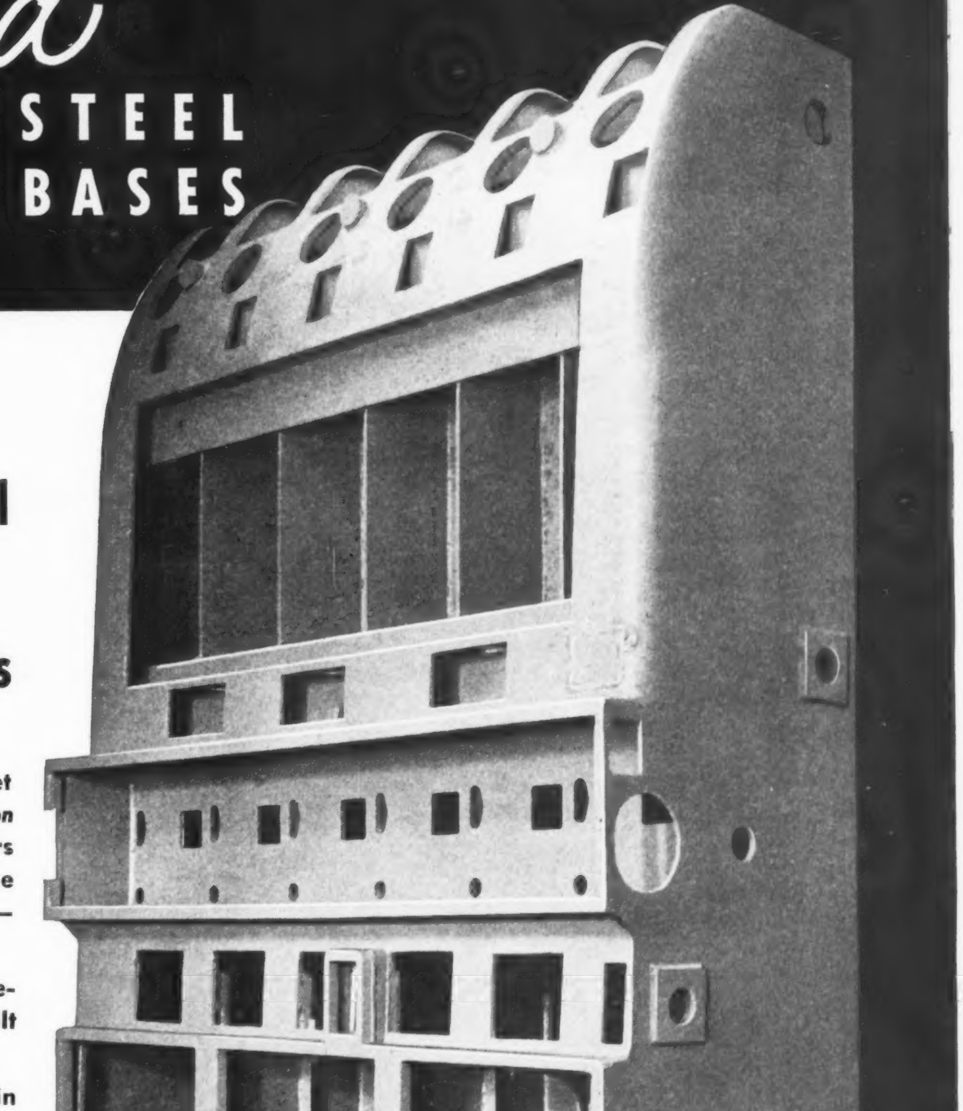
* * *

The War Effort of Industry

As an indication of how industry has met the demand placed upon it by the war emergency, it may be mentioned that the Westinghouse Electric & Mfg. Co. stepped up its monthly production from $34,000,000 worth of equipment last January to more than $52,000,000 in October. To do this, the company has added more than 1500 new employes every month during the past year, or approximately 18,000 for the entire year. In the last four years, the Westinghouse company has spent more than $165,000,000 for additional manufacturing facilities.

Welded STEEL BASES

Base for Multiple Spindle Drill for Drilling Rifle Barrels



IN order to meet vital war production schedules *on time*, machine tool manufacturers must be sure of getting the Machine Bases and Frames they need—*when they need them.*

In ever-increasing numbers, therefore, they are buying bases built by Mahon.

Years of specialized experience in producing intricate designs and unusual sizes and shapes—*plus assurance of delivery as promised*—has established the Mahon organization as an exceptionally dependable source of supply.

Your blueprints will receive our immediate attention. Quotations will be sent you without delay.

THE R. C. MAHON COMPANY
DETROIT • CHICAGO

Manufacturers of welded machine frames and bases and many other steel products.

MAHON

Classified Contents of This Number

WILLOW RUN
Ford's Bomber Plant

By CHARLES O. HERB

This is the first article to appear in any publication that describes bombers actually being produced in the new Willow Run Plant of the Ford Motor Co.

Photo, Albert Kahn Associated Architects and Engineers, Inc.